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Cognitive Modification of Attentional Strategies in Cycling Performance

by

(C)

Timothy H. Clark

A THESIS

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Date. December 13, 1984

ABSTRACT

The central purpose of this study was to investigate the relative effects on cycling performance of four treatments designed to alter the focus of attention of subjects while engaged in an endurance cycling task. The four treatments compared were; attention to task, relaxation, distraction and arousal. A no treatment control group was also part of this design.

The attention to task treatment directed subjects to focus on specific task related demands. These included, bodily feedback, pacing, and breathing. Instructions directing subjects to concentrate on achieving and maintaining relaxation in the major muscle groups involved in cycling formed the content of the relaxation treatment. Both the attention to task and relaxation treatments were based on Morgan's (1978) description of an associative strategy. The distraction treatment directed subjects to concentrate on task irrelevant stimuli (eg. objects in the room, past or future experiences). The arousal treatment instructed subjects to focus on the "motivational factors" of avoiding failure, giving maximum effort and pride.

Following a pre-test on the experimental task, ninety subjects were randomly assigned to one of four treatments or a control group. Subjects assigned to experimental conditions received one of four treatments while engaged in an analogue cycling task. The treatments were administered by the experimenter via a set of headphones. In addition to

total distance and interval distances, ratings on a seven point Likert-style scale were obtained on the variables of discomfort, frequency of task incompletion thoughts (experiential variables), helpfulness of treatment and ability to follow treatment directives (treatment variables). Subjects were also administered the Perceived Rate of Exertion Scale (Borg, 1973). In order to assess subject's naturalistic attentional style the Test of Attention and Interpersonal Style (TAIS, Nideffer, 1976) was administered. Subjects were additionally requested to describe their focus of attention during competition. Finally, subjects were interviewed in a semi-structured format in order to obtain further information about the treatments.

Results indicated no difference between the treatments and controls on any of the outcome measures. Among treatments, the arousal treatment recorded a higher frequency of task incompletion thoughts as compared to both the relaxation and distraction treatments. The arousal group also reported greater discomfort as compared to the distraction treatment. Total distance, perceived effort, frequency of task incompletion thoughts and discomfort were related across groups. An inverse relationship between helpfulness of treatment or ability to follow treatment was found. However, neither of these measures were related to any of the remaining performance or experiential variables. While the TAIS failed to differentiate high and low

performers, subjects self-reported strategies appeared most frequently to involve attention to task and arousal. Responses to the interview regarding helpful and unhelpful aspects of the treatments were diverse and inconclusive.

The results are discussed with the context of recent research and suggestions for further research are offered.

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Table of Contents

Chapter		Page
I.	INTRODUCTION	1
	A. Purpose of the Study	5
	B. Overview of the Study	7
II.	SELECTED REVIEW OF THE LITERATURE	10
	A. Attention and Athletic Performance	11
	B. Anxiety/Activation and Performance	18
	C. Conclusions from the Literature	26
	D. Formulation of the Study	28
	E. Research Questions	34
III.	METHOD	36
	A. Design	36
	B. Subjects	37
	C. Treatments	38
	D. Experimental Task and Setting	40
	E. Experimental Apparatus	40
	F. Procedure	41
	G. Pre Test	42
	H. Experimental Phase	43
	I. Variables	45
	J. Analysis	50
IV.	RESULTS, AND FURTHER ANALYSES	53
	A. Analyses of Variance	53
	B. Performance Curves	59
	C. Correlations	63
	D. Multivariate Analyses of Data	66

E. Summary of Results 68
F. Further Analyses 70
Subjects' Attentional Strategies 71
Results of the TAIS 71
Subjects' Self Reported Strategies 73
Results of the Interview 76
Non-Parametric Analyses 80
V. DISCUSSION, CONCLUSIONS, AND IMPLICATIONS 83
A. Use of Treatments 83
B. Overall Performance and Perceived Effort 85
C. Helpfulness of Treatment 95
D. Ability to Follow Treatment Directives 96
E. Subjects Attentional Strategies 98
F. Post Experimental Interview 101
G. Theoretical Implications of the Study 103
H. Suggestions For Further Research 105
I. Summary of Research Findings 109
REFERENCES 112
APPENDIX I 122
APPENDIX II 124
APPENDIX III 125
APPENDIX IV 126
APPENDIX V 129
APPENDIX VI 132
APPENDIX VII 135
APPENDIX VIII 138
APPENDIX IX 139

APPENDIX X 140
APPENDIX XI 141

List of Tables

TABLE		PAGE
1	Means and Standard Deviations of Subject Age, Weight, Height, Overall Performance on Pre-Test and Ratings of Perceived Effort on Pretest For Treatment Groups and Control Group	54
2	Means and Standard Deviations on Measures of Overall Performance on Post Test, Helpfulness of Treatment; Discomfort, Frequency of Thoughts of Being Unable to Complete the Task, Perceived Effort, and Ability to Follow Treatment Directives	55
3	Analysis of Variance of Mean Scores on Overall Performance Post Test, Reported Helpfulness of Treatment, Discomfort, Frequency of Thoughts of Being Unable to Complete Task, Perceived Effort, and Ability to Follow Treatment Directives	56
4	Critical Q Values Derived From Newman-Keuls Contrasts on Group Means for Reported Discomfort	58
5	Critical Q Values From Newman-Keuls Contrasts on Group Means for Frequency of Thoughts of Being Unable to Complete the Task	58
6	Summary of Results of the Multivariate Analysis of Variance for Treatment Groups and Control Group on Distance Travelled in Each of Six, One Minute Intervals	60
7	Summary of Results of Test for Parallelism of Profile Line Segments	60
8	Summary of Results of Test for Equal Mean Profile Effects	60
9	Mean Distances and Standard Deviations for Five Groups in Each of Six, One Minute Performance Intervals	61
10	Pearson Product Moment Correlations Among Six Variables for Five Groups	64
11	Levels of Probability of Pearson Product Moment Correlations Among Six Variables For Five Groups	65
12	Summary of Results of Analysis of Variance and Multivariate Analysis of Variance	67

TABLE PAGE

13 Frequency of Reported Attentional Strategies Used During Competition 75

14 Summary of Subject Responses to Interview Questions Regarding the Helpful and Unhelpful Aspects of the Treatments and Suggested Improvements 77

15 Relative Rankings of Four Treatment Groups and the Control Group on Six Dependent Variables 82

List of Figures

FIGURE PAGE

1 Mean Distances on Posttest For Five Groups Over Time 62

2 Mean Scores on TAIS of High and Low Performers ...72

I. INTRODUCTION

Recognition of cognitive processes as important mediators of behaviour has grown rapidly over the past decade. The establishment of two new professional journals (Biofeedback and Self regulation, and Cognitive Therapy and Research) as well as several dozen books devoted to the area substantiate this growth.

Increased interest and research activity in this area has given rise to a wide variety of therapeutic procedures subsumed under the generic term cognitive learning therapies (Mahoney & Arnkoff, 1978). Although differing widely in theoretical parentage and technical operations, cognitive therapies share a simultaneous endorsement of the importance of cognitive processes and the efficacy of experimentally developed procedures. Similarly, there is a shared assumption that a person's beliefs, attitudes, expectations, and interpretations influence one's perceptions of himself and his environment and thereby influence behaviour. In general, the cognitive therapist seeks to assist the client in modifying faulty beliefs and attitudes with a view toward the development of more adaptive functioning.

Mahoney and Arnkoff (1978) identify 3 major divisions of current cognitive therapies: 1) cognitive restructuring (e.g. Beck, 1976, Ellis, 1962), 2) problem solving therapies (e.g. Platt, Scura & Hannon, 1973; Mahoney, 1972) and, 3) coping skills therapies. Overlapping with both cognitive restructuring and problem solving approaches, coping skills

therapies represent a heterogeneous collection of intermediate procedures designed to facilitate adaptation to a variety of stressors. Components of a coping skills approach involve self instructional procedures (Meichenbaum, 1972, 1973, 1975) along with supplementary skills such as relaxation training, attention/distraction techniques, imagery, and preperformance rehearsal (Mahoney & Arnkoff, 1978). Clinical applications include the treatment of child birth anxiety (Horan & Dellinger, 1973), phobic disorders (Meichenbaum, 1979; May, 1977) test anxiety (Hussian & Lawrence, 1978), and chronic pain (Meichenbaum & Turk, 1976) to mention a few.

More recently, the area of athetic performance has increasingly drawn the attention of psychologists generally, and coping skills therapists in particular. While this may seem far removed from more traditional clinical concerns interest in this area has arisen out of a number of recent realizations. First, there is a growing awareness that sports are a pervasive aspect of our culture (Michner, 1976) and as such may play an integral role in the socialization of our youth (Mahoney, 1979). Second, sports, in providing reliable outcome measures is well suited to quantative research. In a discipline which devotes considerable energy to the selection and reliability of dependent variables, the allure of straightforward physical indices is noteworthy. Here, speed, distance, and height constitute primary assessment criteria and offer improvements over the

precision of psychometric measures. Finally, and of particular relevance to coping skills therapists, athletic endeavors offer many parallels to the stressors and demands of everyday life. In this respect, sports may provide an invaluable microcosm in which further research may refine our understanding of human adaptation to stressors such as performance standards, aging, pain, coping with failure and so on.

To date, research isolating the cognitive skills associated with effective coping and increased performance in athletics has been largely exploratory and few studies have undertaken controlled experimental manipulations. However, recent reviewers (Kane, 1979, Mahoney, 1979) have identified four cognitive factors as potentially facilitative of athletic achievement. These are: a) self-efficacy judgements (the belief that one is able to produce the necessary behaviour that will lead to a desired outcome), b) mental rehearsal, c) arousal control/relaxational strategies, and d) attentional focussing.

In discussing this last factor Mahoney (1979) speculates; "exploration of attention manipulation skills and effective training methods may well be one of the most promising directions for future sports research" (p. 440). The statement is in part based on the recognition that one's ability to focus attention is a major component in arousal control and preperformance rehearsal techniques. Both of

these techniques have been found effective in assisting athletes out of performance "slumps" (Suinn, 1972, a, b, 1977) and have been associated with increases in performance (Nideffer & Deckner, 1970; Mahoney & Avener, 1977).

Nideffer (1976a) defines attention as, "the ability to direct our senses and thought processes to particular objects, thoughts or feelings" (p. 71). In an analysis of attentional processes in the regulation of human behavior he closely parallels Mahoney's remarks in stating, "it is hard to imagine a variable more central to performance than the ability to control and direct one's attention" (Nideffer, 1976a, p. 395).

The regulation of attentional processes also figures prominently as one of the more effective components in coping skills therapies. For example, Meichenbaum (1975) has identified three mechanisms by which self instructional coping procedures operate. First, self instruction plays a direct regulatory role similar to that of interpersonal instruction: second, it influences the individual's interpretation of his physical state, and third, it directs attention. Comparing the relative effects of these three mechanisms Brucato (1978) reports findings to suggest attentional factors are more influencial. Like many coping skill therapies, self instructional procedures involve to varying degrees relaxation, coping imagery, and self efficacy statements all of which are predicated on the client's ability to shift and control attention

(Meichenbaum, 1975). More importantly, coping self statements such as "Don't think about fear, just think about what you have to do. Stay relevant" (Meichenbaum, 1975, p. 371) are in essence attentional directives to maintain concentration on the task at hand.

It would appear that those cognitive skills linked with sports achievement share much in common with the cognitive skill components associated with effective coping in aversive situations. In both, the regulation of attentional processes is central and may determine the degree to which one is able to utilize other strategies such as relaxation, imagery or preperformance rehersal. Experimental investigations into the most efficacious methods and goals for attentional regulation have been lacking. Additionally, the more central question regarding how various objects of attention affect performance has not been specifically addressed in the clinical or sports research. For example, two popular textbooks (Tutko & Richards, 1971; Cratty, 1973) reveal nothing relevant to the phenomenon and their indices lack references to attention, concentration or thought. Psychological abstracts and the Eric file reference only one controlled study of the phenomenon (Sheedy, 1971).

A. Purpose of the Study

The purpose of this study is to investigate the relative effects of cognitive treatments designed to alter an individuals attentional focus during the performance of

an endurance task. More specifically, three main questions are addressed; 1) Does an individuals' focus of concentration during the course of an endurance motor task influence his level of performance? 2) What are the relative effects of different attentional strategies on an individuals' experience of an endurance task? and 3) Can an individual's attentional strategy be successfully modified during actual performance?

In order to investigate these questions, an analogue study was employed. An analogue study seeks to evaluate aspects of treatments under laboratory conditions designed to resemble the situation as it occurs in every day life. This type of study permits analysis and control of experimental conditions to an extent which may not be possible or practical in a field study. In this particular study, use of analogue research was appropriate because it permitted standardization of the task, control of environmental influences, more precise measurement of outcome indices, and made possible the direct application of a cognitive treatment.

There are however, a number of factors limiting the external validity of any findings arising from this study. The absence of a competitive factor in the research design limits the generalization of results. In addition, the study is not designed to investigate how various attentional strategies combine over the duration of an endurance event to affect performance. This may be important since it is

probable that persons involved in endurance events shift their focus during performance depending on internal or external environmental conditions.

Nevertheless, the use of an analogue in this study fulfilled the major purpose of the research; that is, to assess the relative effects of four cognitive treatments on the performance of an athletic endurance task. The largely exploratory nature of this research is viewed as an appropriate starting point in an area which, as noted, lacks data from controlled experimental research. The study also fulfills an identified need for further research into the most efficacious goals and methods of training attentional regulation (Mahoney, 1979). In addition, the study may produce results with practical applications to assist individuals to perform more consistently with their potential thus acquiring greater benefits from participation. Furthermore, findings regarding effective methods of regulating attentional processes may, theoretically at least, have useful applications in other areas of human endeavor.

B. Overview of the Study

A brief overview of the study is presented here. In investigating the central research questions noted above, subjects were randomly assigned to one of four experimental groups or a control group. The experimental task involved requesting subjects to pedal continuously on a stationary

bicycle for 6 minutes. The bicycle was mounted on a roller system equiped with a wind turbine device designed to simulate actual cycling conditions. A computer connected to the bicycle provided measurements of overall and interval distances.

The experiment was conducted in two stages. The pre test phase was designed to allow familiarity with the task and equipment. In the experimental phase, subjects assigned to an experimental condition received one of four treatments designed to alter their focus of concentration. The treatments followed a written format and were administered by the experimenter through a set of headphones while the subject was cycling. Subjects were then administered a semi structured interview regarding their perceptions of the treatments. Primary outcome measures were overall distance cycled in 6 minutes, distance in each of each of 6, one minute intervals (performance curve), self reported perceived effort, discomfort, and frequency of thoughts of being unable to complete the task (experiential variables), reported helpfulness of the treatment and ability to follow treatment directives (treatment variables).

The four treatments compared were a) instructions to concentrate on the key technical demands of the task (ATTENTION TO TASK), b) instructions to concentrate on various external stimuli irrelevant to task performance (DISTRACTION), c) instructions to concentrate on the relaxation of various muscle groups centrally involved in

the task (RELAXATION), and d) instructions to concentrate on "motivating" factors such as the importance of doing well, giving maximum effort etc. (AROUSAL).

The treatments are described in detail in Chapter II, and Chapter III outlines the method employed in this study.

The purpose of this chapter has been to introduce this study by providing a brief overview of its' historical context, main purpose, and how it was conducted. The following chapter will contain a review of the literature related to the topic of this study.

II. SELECTED REVIEW OF THE LITERATURE

The importance of psychological factors as mediators of athletic performance has long been recognized by both coaches and athletes (e.g. Bannister, 1955). However, it is only within the last two decades that athletics have gained recognition by psychologists as a legitimate field of research focus.

Sports psychology has developed from a personological approach toward increasing emphasis on cognitive skills (Mahoney, 1979). Initially, the personological perspective sought to differentiate elite from non elite performers on the basis of organismic trait factors. Another goal of research in this area was to generate data to assist coaches develop personalities of athletes who frequently experience difficulty in competitive situations. While this avenue of inquiry continues to receive attention it has also received a good deal of unequivocal criticism. Reviewers have consistently pointed to marginal correlations, the inappropriate use of psychometric data, indiscriminate choice of subjects, conceptual and other methodological inadequacies (Kroll, 1970; Mahoney, 1979; Rushall, 1969, 1970, 1972; Smith, 1970).

Unlike organismic trait factors, cognitive skills are viewed as more maleable and thus subject to modification and the development of psychologically based interventions. Relying mainly on self report and naturalistic observation, studies in this area offer few clear conclusions. The

collective evidence is however highly suggestive that cognitive skill variables influence athletic performacnce and more specifically an athletes' ability to control attentional processes maybe of central importance.

A. Attention and Athletic Performance

Genov (1970), in one of the earliest studies, investigated the prepatory concentration of Russian weight lifter Zhabolinski during the 1965 world championships. He found Zhabolinski's concentration time increased with each attempt at a heavier weight and more time was spent preparing for the press and snatch considered a more difficult lift than the clean and jerk.

In another study, Nideffer (1978) investigating the predictive validity of his Test of Attentional and Interpersonal Style (TAIS) found that competitive swimmers scoring high on the TAIS scale measuring funnelled attention were rated by the coach as choking under pressure (r=.75); having to work hard for everything they obtain (r=.66), and becoming worried about one particular thing and unable to do anything else (r=.80).

Related to these results Mahoney and Avener (1977) found Olympic gymnasts consistently expressed confidence in their ability to focus their attention. In an attempt to replicate these findings, Meyers, Cooke, Cullen and Liles (1979) found that racquetball players' ability to focus attention correlated with divisional rankings (r=.87) and

the coaches ranking of the players' ability (r=.66).

There is a general indication here that both the ability to focus attention and the degree to which this occurs have important implications for athletic performance.

Further clarification of the content of attention associated with athletic performance is provided by investigators of "psyching up" strategies. Shelton and Mahoney (1978) requesting weight lifters to "psych themselves up" before a lift found through post experimental interviews that the content of "psyching up" strategies related mainly to self-efficacy, attentional focus, prepatory arousal, and imagery. In an attempt to extend Shelton and Mahoney's findings, Weinberg, Gould and Jackson (1980) investigated the effects of psyching up strategies on three motor tasks measuring balance, strength, and speed of movement. Consistent with the findings of Shelton and Mahoney, these researchers report significant increases in strength but no such increases for balance or speed of movement for subjects in the psych-up condition. Post-experimental interviews established that regardless of the task, the most popular technique was attentional focussing having been used by 40% of the subjects. Approximately 20% of the subjects employed self efficacy statements (e.g. "I told myself I could do it"), relaxation (e.g. "I just tried to relax all of my muscles") and imagery (e.g. "I pictured myself in perfect balance"). Attentional focusing was characterized by statements such as, "I just

tried to concentrate on the task." Regretably, no strategy X subject performance analysis is given thus the question as to how these techniques compare remains unanswered.

While this study identifies four seemingly separate cognitive preparation strategies these may in fact be closely related through attentional skills. For example, an individual must be able to regulate the focus and content of his attention in order to utilize an imaginal rehearsal procedure. The findings of Meyers et. al, (1979) tend to support this point. These researchers report better racketball players self reported a higher clarity of image, less difficulty in controlling imagery, and a greater ability to concentrate on task as compared to less proficient players. Athletes attempting to increase physiological arousal levels may require similarly well developed attentional abilities in order to focus and maintain concentration on suitably provocative thoughts or images.

The processes involved in self efficacy expectations are less well understood, thus the role of attentional skills here is largely a matter of conjecture. It may be that individuals who believe they are able to produce the the necessary behavior are more able to attend to the actual task and therefore perform better. In contrast, the non self efficacious individual is by definition attending not to the task at hand but to his inability to produce the appropriate behavior necessary to successful performance.

A related question pertaining to studies in this area has to do with the specific content and direction of an athlete's attention. A number of investigations have either directly or indirectly addressed this issue. Morgan (1978) investigated the cognitive strategies used by distance runners in overcoming severe physiological stress - the so-called wall. On the basis of self report descriptions, Morgan was able to divide marathoners into two groups: dissociative and associative. The dissociative runner typically isolates himself from the internal physiological events by focusing on non task related stimuli such as his environmental surroundings, educational history and so on. According to Morgan, the dissociative runner is unable to monitor energy output in accord with physiological feedback (i.e. pain). This frequently results in heat exhaustion, hallucinations, abdominal cramps, etc., which negatively affect performance.

The associative strategy on the other hand, Morgan reports, is used by some of the best marthoners in the world. Focussed on their bodily reactions, these athletes are able to constantly adjust energy output and stay within their physiological limits to produce an optimal performance. One tentative conclusion to be drawn here is that attention focussed on the key technical demands of the task (in this case physiological factors) permitted the body to make appropriate adjustments optimally over the duration of an endurance event.

Some indirect support for this hypothesis has been recently obtained. Klinger, Barta and Glas (1981) instructed a college basketball team in thought reporting techniques. Using the number of points scored, attempted, rebounds, assists, and personal fouls as dependent measures, player thoughts were examined during periods when the team scored 2 or more points ("hot time") versus periods when the team had 2 or more points scored against them ("gap time"). Over four games "hot time" thoughts were associated with problem solving about play, future action, game strategy, and preparing self to play. "Gap time" thoughts were found most frequently to contain self exhortations, evaluations and critiques of subjects play or that of the team.

As in Morgan's (1978) study, increased performance appears to be associated with an increased attentional focus on the key elements of the task (i.e. game strategy). Critical ruminations regarding self or other external factors not essential to the technical performance of the task appeared to result in performance deficits. Klinger et. al. concluded among other things, that possibly slight reverses or a strong challenge distract from the flow of concentrated play and "focus attention on a self conscious interaction" (p. 14) which impedes play further. The authors suggest this may be the mechanism which produces "slumps" commonly reported to occur at various periods in an athlete's performance over time.

While this provides an interesting hypothesis, it is difficult to know exactly what is meant by "a self conscious interaction." A study by Gravel, Lemieux and Ladouceur (1980) provided results which shed some light on this question. Using a college cross-country ski team as subjects, these researchers completed an individual behavioral analysis designed to tap each skier's cognitive behavior. Analysis revealed that each competitor experienced anxiety prior to and during each competition. It was also found that a variety of recurrent thoughts constituted different patterns of anxiety before and during the event. Further analysis revealed that these recurrent thoughts could be classified into five themes; (a) ruminations of self depreciation, (b) failure ruminations, and (c) pain ruminations, (d) climatic ruminations, and (e) topographical ruminations. A cognitive behavioral treatment package was administered which involved teaching the athletes in the experimental condition to initiate positive internal images as a means of coping with anxiety producing ruminations. A significant increase in performance and decrease in ruminations was recorded for the experimental subjects. It is noteworthy that the anxiety producing ruminations reported by these athletes in essence consisted of an attentional shift away from task and skill related behaviours. Increases in performance were recorded as attention became focussed on task performance related images. Moreover, this attentional shift appeared to mediate

both their level of anxiety and self efficacy judgements. While this study does not provide data on what initiated these distracting cognitions it does offer a glimpse into the content of the "self conscious interaction" mentioned in the Klinger et. al. (1981) study.

In summary, preliminary evidence suggests the degree to which an athlete is able to focus and maintain his concentration as well as the object of his attention may influence levels of performance. While other cognitive skills such as arousal control, imagery, and self efficacy statements have also been implicated, it is argued that these either directly or indirectly require attentional skills. More importantly, in athletic tasks requiring team play, endurance, and strength, attention to specific task related technical demands appears to facilitate performance to a greater extent than attention focussed on other environmental or situational factors. However, no study to date has attempted to manipulate an athlete's attention during performance thus precise data on how various points of concentration compare in their effect on motor performance remains unanswered.

Before considering this issue in greater depth, the following subsection will deal with the relationship between concentration and anxiety/arousal.

B. Anxiety/Activation and Performance

A major difficulty in addressing this issue is definitional. The terms arousal, anxiety, and activation are frequently used interchangeably creating considerable conceptual ambiguity. This is particularly problematic in sports performance where individuals in the course of physical exercise show many of the same increases in autonomic activity and motor behavior as do individuals under a condition of high anxiety. Nonetheless, most widely accepted definitions of anxiety implicitly or explicitly distinguish anxiety states from those which may be better described as bodily activation.

For example, Speilberger (1966) defines state anxiety as; "characterized by subjective feelings of apprehension and tension, accompanied by or associated with arousal of the autonomic nervous system" (p. 17). As a personality trait, anxiety is defined as; "a motive or acquired behavioral disposition that predisposes an individual to perceive objectively non dangerous circumstances as threatening" (p. 17). Arousal of the autonomic nervous system then is found in both activation and anxiety states. Anxiety is differentiated by feelings of apprehension and the perception of threat where in reality none exists.

It is possible however to reframe Speilberger's definitions of anxiety from an attentional perspective. Assuming that any situation or action contains a probability, however remote, of psychosocial or physical

injury the perception of threat may be viewed as a function of a person's tendency to focus on outcome probabilities of a negative nature. For example, an individual involved in a foot race may chose to concentrate on the probability of injury or the likelihood of humiliating defeat. His participation is thus more likely accompanied by feelings of apprehension than the individual who is able to maintain his concentration on less threatening aspects of the task.

There are two central questions which arise here; first, to what degree is anxiety/arousal facilitative of sports performance?, and second, what is the nature of the relationship between attentional processes and anxiety? If a particular level of anxiety/arousal is associated with a facilitative effect on motor behaviour and it can be shown that levels of anxiety are mediated through the regulation of attention then the possibility exists that motor performance can be altered by a treatment designed to manipulate a person's focus of attention.

In the following, evidence bearing on the relationship between anxiety/arousal and motor performance is reviewed. This will be followed by an examination of the literature elucidating the relationship between anxiety and attentional processes.

In the brief history of sports psychology the relationship between anxiety and athletic performance has received considerable attention (c.f. Fisher, 1976; Morgan, 1972, Nideffer, 1970). A dominating theme in the area has

been the Yerkes-Dodson inverted U hypothesis which asserts that performance is impaired by extremely high or extremely low levels of arousal. While there have been a number of studies cited in support of this relationship (e.g., Ahart, 1973) there is anything but general consensus. In an extensive review of the literature Martins (1972) concludes:

> with respect to the inverted-U hypothesis, many, if not most believe that this relationship is firmly established. The evidence reviewed for varying levels of trait anxiety, induced muscular tension, and psychological stress showed no clear support for this relationship for motor responses... No clear relationships between either trait or state anxiety and muscular performance were elucidated. (p. 61)

Further on the topic of the inverted U hypothesis, it is Epstein's (1972) view that what in fact is measured to the left of the inflection point is the relationship between performance and a state better described as activation. To the right of the inflection point the relationship between anxiety and performance is measured. Assuming this distinction may be accurate, the implication of Epstein's point is that anxiety, that is arousal arising from or associated with perceived threat inhibits performance in a curvilinear relationship.

The differential physiological aspects of the body's response to exercise (activation) versus the stress response (anxiety) is described in further detail by Taylor (1979)

and lends support to this view.

"When a healthy individiual takes exercise the cardio-respiratory system keeps pace with the increased oxygen demands of the tissues so that there is little or no oxygen debt... Although systolic blood pressure rises this is accompanied by a marked increase in blood pressure (p. 179).

"The stress response is generated by a fight or flight reaction... The cardio-respiratory response shows an increase in pulse rate which is disproportionate to increased oxygen uptake and an increase in systolic and diastolic blood pressure, without an equivalent change in cardiac output so that peripheral resistance is increased. The stress response ... is characterized by an increase in peripheral resistance and the overiding of normal baroreceptor control mechanisms for the maintenance of arterial blood pressure (p. 180)."

In short, under activation conditions various physiological mechanisms act in concert to produce efficient functioning. Under conditions of anxiety these physiological mechanisms appear to interact in a desynchronous inefficient fashion. Apparently, as an increasing amount of physical stress is imposed, the body continues to respond in an efficient manner until it reaches its' physiological limits. As anxiety factors are introduced there is a disruption which rapidly produces a depleted condition characterized by oxygen debt, increases in blood pressure unsupported by

cardiac output and so on. Thus, the body's limits of endurance are reached sooner and not necessarily because of increases in actual performance.

It has been suggested (Fisher, 1976; Oxendine, 1970), that different athletic endeavors have different optimal levels of arousal/anxiety. For example, high arousal would be facilitative for performers requiring high level output of short duration such as weight lifters or sprinters. On the other hand, activities requiring fine motor control such as golfing or archery might be better served by minimal levels of emotional arousal. This is logical given the assumption that an optimal level of arousal is an essential pre-condition for an excellent performance (e.g. Mahoney & Avener, 1977; Vanek & Cratty, 1972). However, as noted this assumption has not to date received unequivocal support. On the contrary, recent empirical findings suggest the suppression of anxiety/arousal is more important than its' maintenance at a moderate level. And furthermore, this is at least partially accomplished through the redirection of an athlete's attentional focus.

Fenz (1972) studied the relationship between autonomic arousal and performance in 30 sport parachutists. His results show the best performance was associated with an increase in arousal early in the jump sequence followed by a sharp decrease in arousal to near normal levels which continued until the subject's actual exit from the plane. This was later supported (Fenz, 1973, 1975) in studies of

the same population which revealed significant differences in arousal patterns distinguishing elite from non-elite parachutists. Typically, the arousal level of the elite jumper rapidly declined as the athlete engaged in the task while the arousal of the non-elite jumper continued to esculate. Fenz (1973) hypothesized that there develops a gradient of anxiety and a gradient of inhibition of anxiety in relation to a goal which has both a positive and negative valence. Assuming the gradient of inhibition of anxiety is greater than the gradient of anxiety and becomes so with increasing exposure to the source of threat, Fenz (1973) asserts the interaction of the two gradients causes a shift in the peak of arousal forcing the individual to attend to low relevance cues which act as warning signals of forthcoming danger. The resultant inhibition of anxiety to near normal levels "has a direct impact on performance." Stated simply, the good jumper becomes externally focused on the task at hand as the jump sequence begins whereas the poor jumper remains internally focussed on his subjective experience of fear and apprehension.

The major point here is that near normal levels of autonomic arousal are associated with attentional shifts and elite performance for parachutists at least. This is consistent with the results of Borkevic and O'Brien (1977) who found physiological, behavioral, and self report indices of fear can be reduced by the manipulation of attention. Similarly, in the Gravel et. al. (1980) study cited earlier,

anxiety producing ruminations were decreased and performances facilitated by teaching cross country skiers to re-focus on positive task related internal images. Likewise, in discussing his exploratory study of Olympic gymnasts with Avener (1977), Mahoney (1979) made two salient observations; a) that all of the athletes were very anxious, and b) markedly different coping strategies differentiated Olympic qualifiers from non-qualifiers. The remarks of one non-qualifier are given as representative:

> When I start chalking up, I feel all queasy and I think to myself "Oh shit, am I scared. Six thousand people watching. What if I make a mistake? What if I fall off? I hear myself talking like this and I know I'm not ready."

This is in contrast to the focus of the self talk of the Olympic qualifier:

> "I get out there and they're waiting for me and all I can think of is how scared I am. Twelve years I've worked to lay my life on the line for 30 seconds. Then I try to concentrate - OK, this is it; its now or never. Let's pay attention to your tuck, stay strong on the press out and be ready for that dismount." (cited in Mahoney, 1979, p. 436).

It is apparent that the qualifying gymnast attempts to cope with fear ruminations through a forced attentional shift toward the specific demands of the task at hand. In contrast, the non-qualifier fixes his attention on the

physical and psychosocial consequences of failure. Like Fenz's parachutists, it is likely the arousal these athletes experience continues to esculate which further interferes with their ability to focus on the task resulting in a less than optimal performance. It may well be that both the object of attention and one's interpretation serve to create a cycle of self defeat. Failure ruminations are supported and given credence by one's belief that he is inadquately prepared, producing more intense failure ruminations and so on. This is consistent with a study by Epstein and Fenz (1962) which showed that the knowledge of the level of anxiety may lead an athlete to a misinterpretation of his abilities.

In consideration of these data, the conjecture offered by Fischer (1976) and Oxendine (1970) that there is an arousal x athletic event facilitation interaction is challenged. It is suggested here that arousal/anxiety interferes with athletic performance to a greater or lesser degree depending on the nature of the task. More importantly, the athletes' ability to control arousal may be determined in part on the degree to which he is able to manipulate his attentional processes. Attention focussed on specific task demands may permit the efficient orchestration of appropriate responses necessary to successful performance. This may further control the body's fight-flight response commonly occurring in competitive situations and associated with inefficient physiological

functioning.

It is of interest that both coaches and athletes believing that heightened arousal/anxiety facilitates performance commonly provide an object of attention which is inherently anxiety provoking in as much as it implicitly supplies an avoidance motive. Exhortions such as; "this is the big game, if we lose, there's no tomorrow" or "we can't let our fans down" are frequently encountered examples of coaching style in the Knute Rockne vien.

In essence, the athlete is given a focus of attention which encourages high levels of performance in order to avoid the evaluatively negative consequences of losing "the big one" or letting his fans down. Like Mahoney's non-qualifying Olympic gymnasts and Fenz's parachutist's a type of "self conscious interaction" mentioned earlier may take the form of attention devoted to the psychosocial consequences of failure; "what if I lose, what will the fans think of me" and so on. As Fenz (1973) has pointed out, it may be the athlete's inability to shift his attention to task relevant cues which interferes with performance.

C. Conclusions from the Literature

It is argued that cognitive coping skills such as imagery, arousal control and self efficacy judgements are directly or indirectly predicated on an individual's ability to regulate attentional processes. Thus far, there is evidence to suggest that an athlete's ability to maintain

concentration on the key technical demands of the task facilitate performance (Morgan, 1978; Meyers et al., 1979; Mahoney & Avener, 1977; Nideffer, 1976; Klinger et al., 1981). Likewise, attentional focusing is naturalistically employed as a performance preparation strategy (Sheldon & Mahoney, 1978; Weinberg et al., 1980) and interferred with during periods of anxiety. Conversely, relaxation procedures (Nideffer & Deckner, 1970; Suinn, 1972, a,b) which involve teaching the athlete to redirect attention have proven beneficial. However, these studies in relying on self report and naturalistic observation methodologies have failed to demonstrate under controlled experimental conditions the relative effects on performance of specific attentional strategies. Furthermore, few studies to date have attempted to manipulate attention under controlled conditions while the athlete is actually performing. In those that have (Gravel et al., 1980 & Suinn, 1972) the performer has been trained to focus on complex internal images containing many elements such as muscular relaxation, arousal or self efficacy related imagery.

The relative effects on performance of each of these attentional elements is not entirely clear as it is likely any overall results are a product of an interaction. For example, Suinn (1972, a,b, 1977) used a technique called Visual Motor Behavior Rehearsal (VMBR) in an effort to assist cross country skiers to stop negative or distracting thoughts which detracted from their concentration on their

skiing. This technique involved a number of component procedures including relaxation, visualization and thought stopping. The process involved having the skier practice in slow motion under simulated competitive stress until maladaptive cognitive habits were modified. Although no statistical data are provided the author concludes, on the basis of self report indices, that racers who received the treatment performed better than the no treatment control group.

It has been argued (Gravel et al., 1980) that Suinn's VMBR achieved positive results by helping the skiers control and direct their concentration on the task of skiing. However, since the treatment involved a number of attentional directives (e.g. concentration on muscular relaxation, terrain, etc.), the question as to how each focus of attention affected performance remains unanswered.

The present study seeks to investigate the relative effects on performance of four cognitive treatments designed to alter the concentration of individuals while they are performing an athletic endurance task.

D. Formulation of the Study

An ergonomic cycling exercise was chosen as the experimental task for the following reasons. First, like many motor activities cycling requires in varying degrees speed and strength but most notably endurance. Endurance defined as an individual's ability to maintain a constant

energy output over time is perhaps one of the most critical aspects to successful athletic performance. For example, it is a physical ability demanded in individual sports (e.g. tennis, racketball, squash, running), and team sports (e.g. soccer, rugby, waterpolo). While other attributes such as skill, speed, and strength figure prominently, the athletes ability to put these to good effect are predicated on endurance factors or the amount of energy available at any given point in time. Thus, the elucidation of a relationship between cognitive variables and endurance is viewed as having broader implications than data bearing on the relationship between cognitive variables and some other specific athletic attributes.

Further, unlike athletic events such as weightlifting, and mountain climbing the attentional demands and performance stressors involved in cycling over a relatively short time period are not so great as to interfere with the subjects' ability to attend to the treatment. Since the treatments and delivery methodology used in this study have not been previously employed in published sports psychology research it is difficult to estimate the parameters of an effective attentional treatment in terms of length and content.

In light of this, a treatment administered over several minutes is viewed as probably more effective than one administered over only a few seconds. Cycling is one of the few athletic tasks which can be easily extended or shortened

according to the length of the treatment. In addition, this can be accomplished without introducing elements of laboratory artificiality which may detract from the tasks approximation to an actual event and limit the generalizing of results. Finally, cycling is a task regularly pursued by a large number of people, and as such ensures wide availability of potential subjects.

Measurement of distance over a set time interval was chosen over the more customary practice of timing an event over constant distance. This was designed to discourage the formation of performance expectations which have been shown to affect athletic performance (Diggory, Klein & Cohen, 1964; Vidacek & Wishner, 1971, 1972) particularly in enduarance events (Taylor, 1979).

The four treatments compared were:

1. Attention to Task

The objective of this treatment was the direction of subjects to concentrate on the critical technical demands of cycling. Since cycling is primarily influenced by endurance factors subjects were instructed to focus their attention on breathing, bodily feedback and setting a pace in accord with this feedback. This latter factor has been found of central importance in elite distance running. Examining world records for distance running events between the years 1864 and 1975, Ryder, Carr and Herget (1976) conclude;

> With few exceptions world records are set by runners whose speed is constant within a few percent after

> the initial buildup. We call this phenomenon the Aesop principle...slow and steady wins the race (p. 111).

The importance of concentrating on breathing and bodily feedback was found by Morgan (1978) as differentiating elite from non elite marathoners and may be integral to an optimal level of energy output according to the Aesop principle.

2. Distraction

This treatment was designed to focus the subject's attention on stimuli irrelevant to the execution of the task. This includes physical objects present in the situation as well as past and future experiences. As noted in the preceding literature review, distraction strategies are often employed by marathon runners to cope with physical stress (cf. Morgan, 1978). Distraction treatments have also been administered in clinical situations and reported effective in assisting people cope with pain and reduce anticipatory anxiety associated with pain (Leventhal & Everhart, 1979).

In sports psychology one controlled study reported using a distraction treatment. Shelton and Mahoney (1978) found weightlifters administered a counting backward distraction procedure performed significantly poorer than weightlifters instructed to "psych themselves up." The effects of a distraction cognitive strategy on performance of an endurance event have not been the subject of a controlled experimental study to date.

3. Arousal

The object of this treatment was to direct the subject's attention to the importance of doing well, pushing oneself to his physical limits and that he has only the one opportunity to demonstrate his ability. The treatment was designed to correspond with widely practiced coaching techniques which attempt to increase an athlete's "motivation". These techniques are based on the notion that "a high level of arousal is essential for optimal performance in motor activities involving strength, endurance and speed" (Oxendine, 1970, p. 137). While research investigating the content of "psyching up" strategies have also found that subjects naturalistically attempt to cognitively increase arousal levels (e.g. Shelton & Mahoney, 1978) the relative effects of this strategy compared with other attentional strategies on an endurance task have not been investigated.

4. Relaxation

Subjects in this condition were administered a treatment designed to focus attention on the relaxation of major muscle groups involved in cycling (e.g., thighs, calves, shoulders, back, etc.). Relaxation techniques have been shown effective in assisting athletes and are used in some coaching situations (cf. Fisher, 1976; Morgan, 1972; Nideffer & Deckner, 1970).

There are however relatively few controlled studies of the effects of muscular relaxation in sports research (Mahoney, 1979). Morgan (1978) reports that elite marathoners often reminded themselves to "stay loose", "relax and not tie up" (p. 39). He viewed this attention to relaxation as part of a general associative cognitive strategy which as noted also involved concentration on the body's sensory feedback.

The degree to which concentration on muscular relaxation contributed to performance as compared to the effects of attention focussed elsewhere remains unanswered.

The treatment delivery methodology used in this study involved communicating the treatment to subjects via headphones while they were engaged in the experimental task. While this methodology has not been employed in published sports research to date, there is preliminary evidence to suggest it can be used to effectively direct and focus the attention of athletes in some sports (Allard, 1982). An added advantage of this methodology is that it permits the administration of a treatment while the subject is performing and its immediacy may offer a noteworthy improvement over pre-task cognitive skills training methods. For example, Hackett and Horan (1980) investigating a self instructional paradigm designed to assist people to cope with pain found that subjects frequently did not use the coping strategy taught.

E. Research Questions

1. What are the relative effects on overall performance (as measured by the total distance travelled during the 6 minute cycling task) of the four treatments as compared to each other and the control group?

   On the basis of the preceeding literature review it is hypothesized that subjects receiving the attention to task treatment will produce significantly higher levels of overall performance as compared to the overall performance of subjects in the remaining treatment groups or control group.

   The following questions will form the exploratory part of this research.

2. What are the relative effects of the four treatments on subjects' experience of the task as measured by ratings of physcial discomfort and frequency of thoughts of being unable to complete the task?
3. How do the four treatments compare on ratings of the treatments helpfulness?
4. Were subjects able to follow the treatment directives presented?
5. What are the relative effects of the four treatments on subjects' performance curves (as measured by the distance travelled in each of six, successive one minute intervals)?
6. To what extent is overall performance, perceived effort, discomfort, frequency of thoughts of being unable to

complete task, helpfulness of treatment, and ability to follow treatment directives related across groups?

III. METHOD

The main purpose of this study is to compare the effects of four cognitive modification treatments and a control on performance of an endurance cycling task. In addition, a number of other questions outlined in Chapter II will be answered. The method employed to carry out this study is described in this chapter.

A. Design

A total of 90 subjects were randomly assigned to one of five groups: (a) a no treatment control group (CONTROL), (b) attention to the relevant technical demands of the task (ATTENTION TO TASK), (c) attention to task irrelevent stimuli (DISTRACTION), (d) attention to motivating factors (AROUSAL), and (e) attention to bodily relaxation (RELAXATION). All groups with the exception of the controls received a cognitive treatment while performing the experimental task of continuous cycling for 6 minutes. Each group was administered the 6 minute cycling task twice: first, without any treatment, in order to provide subjects familiarity with the task. During the second administration of the task all subjects with the exception of the control group received a treatment through a set of earphones while cycling.

The design of the experiment has been classified by Campbell and Stanley (1963) as a pre test - post test control group design.

B. Subjects

A total of 111 subjects participated in the experiment. Thirteen of these did not return for the experimental phase; an additional five subjects were omitted from analysis due to equipment failure, and two subjects were dropped because they failed to complete the paper and pencil test. The remaining 90 subjects were randomly assigned to conditions.

The subject sample was made up of male volunteers from three local running clubs and an organized adult soccer league. The Alberta under 18 select soccer team also agreed to participate and contributed 13 subjects. The subject sample contained 29 soccer players and 61 runners. All of those subjects who failed to return for the second phase of the experiment were soccer players. These subjects were approached through their respective coaches and likely agreed to participate under some coercion which may account for their reluctance to participate fully. However, since randomization occurred during the second phase of the experiment the absence of these subjects did not bias the results.

Subjects were requested by the experimenter to participate in a study investigating the relationship between concentration and athletic performance. A brief description of the experimental task and procedure was also given. To avoid possible bias, it was ensured that none of the subjects had prior experience with competitive cycling or were presently in training for competitive cycling. All

subjects reported a belief that psychological factors influenced athletic performance and indicated an interest in learning more about these factors.

Subjects ranged in age from 16 to 60 years, with a mean age of 31.6 years, and a standard deviation of 11.48 years. As a group, the soccer players ranged in age from 16 to 28 years, (mean 21.8, standard deviation 5.80 years) while runners ranged in age from 22 to 60 years, (mean 34.2, standard deviation 9.61 years).

C. Treatments

Subjects assigned to the four experimental conditions were administered a treatment designed to alter their focus of attention while performing the cycling task. Each treatment consisted of 6 instructional units or directives. Each directive was approximately 15 seconds in duration, followed by a 10 second pause, then a 10 second prompt, a 5 second pause, another 10 second prompt, and finally a 10 second pause before the next directive was administered.

In order to enhance experimental precision each treatment directed the subjects to attend to only 3 aspects relative to the particular condition. Corresponding to the duration of the experimental task each treatment was 6 minutes in length. Each directive requested the subject to concentrate on one aspect for one minute. Thus 2 instructions were devoted to each of three aspects in each condition.

The four treatments compared were:

1. ATTENTION TO TASK:

Subjects were instructed to concentrate on (a) bodily feedback, (b) maintaining optimal pedal rhythm in accord with this feedback and, (c) maintaining regular breathing. (Appendix IV)

2. RELAXATION:

Subjects were requested to focus their attention on (a) staying loose, (b) relaxing their upper body and, (c) monitoring general musculature for any signs of tension or strain with a view toward containing and decreasing the sensation of tension (Appendix V)

3. AROUSAL:

Subjects in this condition were instructed to concentrate on the evaluative aspects of the task. This included, (a) the importance of doing well, (b) pushing themselves to the limits of their endurance in order to avoid failure and, (c) concentration on what failing to produce a good performance will mean to them personally. (Appendix VI)

4. DISTRACTION:

Subjects were requested to focus their attention on task irrelevant stimuli. This included, (a) objects present in the room other than the cycling equipment, (b) past events of particular interest or importance and, (c) anticipated activities in the near future. (Appendix VII)

D. Experimental Task and Setting

The experimental task involved requesting subjects to pedal continuously for 6 minutes on a stationary bicycle.

The experiment was conducted in a seminar room located on the University of Alberta campus. In order to minimize distraction subjects were situated on the stationary bicycle in front and slightly forward of the experimenter. The 6 minute duration of the experimental task was considered sufficient to insure performance was predominantly related to aerobic versus anaerobic endurance factors.

E. Experimental Apparatus

A standard 10 speed type bicycle with a 23 inch frame was used. Seat and handle heights were adjusted to accommodate each subject. The bicycle was fixed to a roller device (Racer-Mate II), in which the rear wheel rests at a constant pressure on a wind turbine. The wind turbine is rotated by friction with the revolving rear wheel of the bicycle and increases resistance proportional to the speed at which the subject pedals. The device is designed to simulate actual cycling conditions.

In order to decrease mechanical complexity which may have proved a disadvantage to those unfamiliar with the operation of a 10 speed bicycle, the normal 10 speeds were reduced to 1 by fixing both the front and rear derailleur. The gearing was such that one pedal rotation produced 3.23 rotations of the rear wheel or 86.40 inches of travel.

Treatments were conveyed by the experimenter through stereo microphones leading into a set of earphones worn by the subject. The earphones were requried in order to make the treatment instructions audible over the considerable noise generated by the roller device. An added advantage of this methodology lay in its greater immediacy compared to pre-task cognitive skills training methods. It also permitted the experimenter to speak directly to the subject and use the subjects' first name which was viewed as promoting greater responsivity and more likely to enhance compliance with the treatment instructions.

An electronic computer (Cat Eye-Velo Cyclocomputer model 1000) was used to measure performance. This device measures ten functions through an electronic sensor located near the axle of the rear wheel. The functions utilized in this study included overall distance and distance travelled in each minute of the 6 minute task. Distance is displayed in meters and the manual reports an accuracy to within 0.01 kilometers over 999 kilometers.

A stopwatch was used to time the subjects on the cycling task.

F. Procedure

The experiment was conducted in two phases. In the first phase subjects were pre tested on the 6 minute cycling task. The purpose of this was to permit familiarization with the task and apparatus.

In the second phase, subjects were randomly asssigned to one of four experimental groups or a control group. Subjects assigned to the experimental conditions were administered a cognitive treatment through a set of headphones while performing the 6 minute cycling task. Control subjects performed the same task but did not recieve a treatment. In both phases subjects were run individually. Approximately 7 to 10 days elapsed between the two phases.

G. Pre Test

Upon entering the laboratory subjects were administered a brief questionaire (Appendix I) designed to record demographic data and obtain information regarding each subjects' naturalistically employed attentional strategy. In order to reduce bias, enquiries were made of all subjects as to whether they had prior experience with, or were presently training for competitive cycling. None of the subjects were disqualified for either of these reasons. All subjects indicated a belief in the importance of psychological factors in sports performance and expressed a desire to learn more about these factors.

After completing the above questionaire subjects were told the experiment was an investigation into the relationship between concentration and the performance of an endurance event. It was further explained that the purpose of the pre test was to obtain base line data and give them some familiarity with the task.

A brief introduction to the experimental cycling apparatus followed. Subjects were then told the experimenter was interested in how far they could go in 6 minutes of continuous pedaling. Subjects were permitted to complete any warm up or stretching exercises before being seated on the bicycle as already described. A further warm up on the bicycle was permitted after adjustments and functional checks of the equipment were made. When subjects signalled a readiness to begin the instructions were briefly repeated and subjects were informed that feedback regarding elapsed time would be communicated at 2, 4 and 6 minutes. (Appendix II)

After completing the cycling task subjects were allowed a brief 3 minute cool down. Subjects were then administered the self report Percieved Rate of Exertion Scale (PRE Appendix XI) and the Test of Attentional and Interpersonal Style (TAIS).

H. Experimental Phase

Subjects were randomly assigned to groups as described and required to perform the same 6 minute cycling task outlined above. The procedural administration of the task was the same as in the pre test phase. All subjects were required to wear a set of stereo headphones while performing the cycling task. Subjects assigned to experimental conditions received a treatment through these head phones while cycling. The control group wore the headphones but did

not receive any form of auditory stimulation aside from feedback regarding elapsed time and start/stop commands.

Prior to beginning the cycling task all subjects were read the same introduction and instructions by the experimenter, the script of which is presented in Appendix III. It reiterated the basic instructions for the task and briefly described the purpose of the headphones. Subjects were informed as to the types of scales on which they would be required to rate the experience following completion of the task. In order to decrease experimental demand factors subjects were informed that the study was exploratory and that no directional hypotheses were being tested. Before subjects commenced the cycling task they were asked if they had any questions about the procedure.

After completing the cycling task subjects were administered the PRE scale and asked to rate their experience on four likert style scales. (The items are contained in Appendix VIII.) Subjects were then requested to respond to a semi-structured interview administered by the experimenter. (See Appendix IX) The purpose of this was to obtain greater clarity of the subjects written respones and to give subjects and opportunity to verbalize in greater detail their reactions to the experiment.

Subjects in the control group followed an identical procedure. However, questions pertaining to treatments were omitted. In order to assess the effects of the treatments the following dependent measures were employed.

I. Variables

1. TOTAL DISTANCE

Overall performance as measured by total distance (in meters) travelled during the 6 minute cycling task.

2. INTERVAL DISTANCE

Distance travelled in each one minute interval of the 6 minute task was obtained.

Interval and overall distances were obtained from subjects in both the pre test and experimental phase of the study.

3. PERCEIVED EXERTION

Borg's (1973) Perceived Rate of Exertion (PRE) scale was administered following both the pre test and experimental phases of the study. The scale was administered in order to obtain a measure of the subjects' perceptive estimation of work intensity.

The PRE is a 14 point graded scale consisting of numbers from 6 to 20 presented vertically with descriptive words printed by every other number, ranging from "very, very light" at 7 to "very very hard" at 19. The task of each subject is to assign a numeral to represent the subjective sensation of the amount of work performed.

It has been demonstrated that perceived exertion and work intensity on a bicycle ergometer is correlated in a linear fashion (Borg, 1962; Borg & Linderholm, 1967; Frankenhaeuser, Nordheden & Sjoeberg, 1969;

Skinner, Borg & Buskirk, 1970, cited in Morgan, 1973). These studies also report correlations between successive increases in cardiac output and ratings of perceived exertion ranging between .75 and .90. The scale has also been found to be unaffected by activity history or body composition (Skinner, Borg & Buskirk, 1970 cited in Morgan, 1973) and is not correlated with maximal aerobic power on a bicycle ergonometer task (Morgan & Nagle, 1973, cited in Morgan, 1973).

In order to further assess the effects of the treatments, subjects were asked a number of questions along the following dimensions. All of the responses were scored on a seven point Likert-style scale.

1. Use of treatment: Subjects' response to the question: "Indicate to what degree you were able to follow the directions given to you while cycling." (1-not at all, 7-all of the time).
2. Helpfulness of the treatment: Subjects' response to the statement: "The instructions I received while cycling were helpful to me in performing the task" (1-strongly disagree, 7-strongly agree).
3. Frequency of thoughts of being unable to complete the task: Subjects' response to the question: "During the experiment there were times when I thought I might not be able to continue." (1 - not at all, 7 - all of the time).
4. Discomfort: Subjects' response to the question:

"Indicate the degree of physical discomfort you experienced while cycling." (1 - very low, 7 - very high).

Subjects were additionally asked the following open ended questions.

5. "Would you care to elaborate further on any of your responses above."
6. "In your opinion, how could the instructions you received be improved?"
7. "Were there any aspects of the instructions which you found particularly helpful?"
8. Were there any aspects of the instructions you found particularly unhelpful?"
9. "Is there anything I haven't asked you about that you think might be important for me to know?"

Subjects in the control group responded to questions 3,4,5, and 9 on a separate questionnaire.

Attentional Style

In order to assess subjects' naturalistic style of attentional focussing the Test of Attentional and Interpersonal Style (TAIS, Nideffer, 1976b) was administered.

The TAIS is a 144 item paper and pencil test. Subjects respond to each item by indicating the frequency with which the item describes their behavior. The test items and content require subjects to be fifteen years old or older and can be completed in 20 to 25 minutes (Nideffer, 1976b).

The TAIS is based on the following theoretical assumptions: 1) that an individual's ability to concentrate is learned and can be described along dimensions of width (broad-narrow) and directionality (internal-external). 2)That certain situations tend to require one dominate type of attention or attentional demand. 3) That effective performance is related to the degree of correspondence between the type of attentional focus situationally demanded and an individuals' attentional style. 4) It is assumed that individuals cannot demonstrate more than one type of attentional focus at any given time, thus effective performing requires the ability to shift rapidly from one type of attention to another.

By crossing the dimensions of width and directionality four major types (styles) of attention are obtained. These are: a) Broad-Internal, used to integrate and organize a large number of internal thoughts and perceptions, b) Broad-External, used to quickly assess environmental situations, and c) Narrow-Internal, employed when an individual must focus on one line of thought as in performing mathematical calculations. The TAIS provides a measurement of an individuals' tendency to make different types of attentional errors (eg. to become distracted by stimuli in the environment versus being distracted by one's own thoughts). The tendency to make specific kinds of attentional errors is described along 6 scales which are summarized below from the manual (Nideffer, 1976b).

1. Broad External Attentional Focus - BET

   High scorers on this scale describe themselves as being able to effectively integrate many external stimuli at one time.

2. Overloaded by External Stimuli - OET

   High scorers tend to make mistakes because they become confused and overloaded with external stimuli i.e. distracted.

3. Broad Internal Attentional Focus - BIT

   High scorers see themselves as able to effectively integrate ideas and information from several different areas. Such individuals are described as having good planning abilities, and anticipatory responses.

4. Overloaded by Internal Stimuli - OIT

   High scorers make mistakes because they confuse or distract themselves by trying to think of too many things at once, becoming lost in thought and day dreaming.

5. Narrow Attentional Focus - NAR

   High scorers tend to see themselves as being able to effectively narrow attention when desired and sustaining concentration.

6. Reduced Attentional Focus - RED

   High scorers tend to make mistakes because of an over narrowing of attention such that irrelevant cues, such as distracting noises become the dominate focus.

Of only secondary interest to the present study the TAIS provides two scales measuring behavior control variables and ten interpersonal variables (eg. self esteem, depression, introversion, extroversion, etc.)

The test-retest reliability coefficients for the attentional scales have been found to range over a two week period from .60 to .93 with a median of .83 (Nedeffer, 1976b).

The TAIS has been found to discriminant between males and females (La Motte, 1981; Schmelzer, 1981; Boney, 1982 cited in Nideffer, 1976b). It has also been found to differentiate elite from non elite athletes in the sports of shooting, gymnastics, golf, diving, and swimming (Jackson, 1981; Nideffer, 1978; Kerschenbaum & Bale, 1980; Landers, 1978; Aronson, 1982).

J. Analysis

In Chapter II the purposes of the study were specified. The questions addressed in this study are reiterated here, followed by the method of analysis employed in answering the questions.

1. What are the relative effects on overall performance (as measured by total distnace travelled during the six minute cycling task) of the four treatments as compared to each other and the control group?

   HYPOTHESIS: It was hypothesized that subjects receiving the attention to task treatment would show significantly

higher levels of overall performance as compared to the subjects receiving the arousal, distraction, relaxation treatments or control group.

A one way analysis of variance was used, comparing the mean scores of each of the treatment groups to each other and the control group on the measure of overall performance.

2. What are the relative effects of the four treatments on subjects' experience of the task as measured by ratings of perceived effort, physical discomfort, and frequency of thoughts of being unable to complete the task?

A one-way analysis of variance was used comparing the mean scores of four treatment groups and control group on the measures of perceived effort, discomfort and frequency of thoughts of being unable to complete the task.

3. How do the four treatments compare on ratings of the treatment's helpfulness?

A one-way analysis of variance was used to compare the mean scores of the four treatments on measures of reported helpfulness of treatment.

4. Were the subjects able to follow the treatments directives as presented?

A one-way analysis of variance was used comparing mean ratings on the measure of ability to follow treatment directives.

5. What are the relative effects of the four treatments on

subjects' performance curves (as measured by the distance travelled in each of six, successive one minute intervals)?

A multivariate analysis of variance (profile analysis) was used comparing the mean distances obtained for each group for each time interval.

6. To what extent is overall performance, reported perceived effort, discomfort, frequency of thoughts of being unable to complete the task, helpfulness of treatment and ability to follow treatment directives related across groups.

Pearson product moment correlations between the above named variables were derived.

In the analysis of the data, a probability level of $P<.05$ was deemed necessary to support the hypothesis that the differences that exist occur at a greater degree than what might be expected by chance.

Results of the interview questions regarding the helpful and unhelpful aspects of the treatments as well as suggested improvements will be summarized. Additionally, subject responses to the question regarding attentional strategy during performance will be analyzed along with an analyses of the results from the administration of the TAIS.

IV. RESULTS, AND FURTHER ANALYSES

In this chapter results of the analyses suggested in the previous chapter are presented. This will be followed by a discussion of the results and further analyses of the collected data.

A. Analyses of Variance

Table 1 summarizes the means and standard deviations on subject characteristic variables of age, weight, height, overall performance, and perceived effort ratings on pre-test.

Results of an analyses of variance indicate no significant differences among the five groups on these subject characteristic variables.

A multivariate analyses of variance (profile analyses) of group means for each of the five attentional scales obtained from the administration of the TAIS, similarily revealed no significant differences among the five groups.

Table 2 summarizes the analyses of variance of differences among the five groups on the measures of overall performance (post-test), reported helpfulness of the treatment, discomfort, frequency of thoughts of being unable to complete the task, perceived effort, and reported ability to follow treatment directives. The means and standard deviations for the five groups on each of these measures is presented in Table 3.

TABLE 1

Means and Standard Deviations of Subject Age, Weight, Height Overall Performance on Pre-Test and Ratings of Perceived Effort on Pretest For Treatment Groups and Control Group

	1 (ATTENTION TO TASK)		2 (RELAXATION)		3 (DISTRACTION)		4 (AROUSAL)		5 (CONTROL)	
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
Age (years)	28.27	10.60	31.77	11.25	34.88	11.61	33.61	13.55	30.33	11.18
Weight (lbs.)	157.33	17.10	150.66	18.04	163.00	13.79	159.11	12.16	158.55	17.67
Height (inches)	69.77	3.67	69.05	2.62	70.94	2.46	70.00	2.11	70.00	2.25
Overall Performance Pre-Test (meters)	3016.66	410.69	2899.44	340.04	3048.33	381.71	3027.22	254.55	2909.99	282.59
Perceived Effort Pre-Test	15.33	1.45	14.94	1.69	15.61	1.78	15.11	1.87	14.55	2.30

TABLE 2

Means and Standard Deviations on Measures of Overall Performance on Post Test, Helpfulness of Treatment, Discomfort, Frequency of Thoughts of Being Unable to Complete the Task, Perceived Effort, and Ability to Follow Treatment Directives

	1 (ATTENTION TO TASK)		2 (RELAXATION)		3 (DISTRACTION)		4 (AROUSAL)		5 (CONTROL)	
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
Overall Performance Post-Test (meters)	2946.11	351.87	2816.66	358.34	2994.44	240.61	3016.11	312.29	2991.66	248.27
Discomfort	4.55	.983	3.72	1.48	4.33	1.49	5.38	1.14	4.77	1.16
Frequency of Thoughts of Not Being Able to Complete Task	3.22	2.18	1.72	1.64	1.88	1.07	3.55	2.25	2.94	1.62
Perceived Effort	15.00	1.57	13.83	2.77	15.11	2.21	15.88	1.36	14.77	2.28
Ability to Follow Directions	5.77	1.11	5.72	.894	5.66	.840	5.16	1.09	N/A	--
Helpfulness of Treatment	5.38	1.53	4.50	1.33	4.11	1.49	4.94	1.47	N/A	--

TABLE 3

Analyses of Variance of Mean Scores on Overall Performance (Post Test), Reported Helpfulness of Treatment, Discomfort, Frequency of Thoughts of Being Unable to Complete Task, Perceived Effort, and Ability to Follow Treatment Directives

	SOURCE OF VARIATION	df	MS	F RATIO	P
Overall Performance On Post Test	Between Groups	4	116227.75	1.24	0.301
	Error	85	93857.88		
Discomfort	Between Groups	4	6.69	4.14	.004
	Error	85	1.62		
Frequency of Thoughts of Being Unable to Complete Task	Between Groups	4	12.03	3.68	.008
	Error	85	3.27		
Perceived Effort	Between Groups	4	9.82	2.21	.074
	Error	85	4.44		
Ability to Follow Treatment Directives	Between Groups	3	1.43	1.44	.238*
	Error	68	0.99		
Helpfulness of Treatment	Between Groups	3	5.50	2.57	0.062*
	Error	68	2.14		

* The control group did not receive measures of helpfulness of treatment and ability to follow treatment directives and thus were excluded in the analyses of variance on these variables.

Results of the analyses of variance indicated significant differences among the five groups on the measures of reported discomfort ($P<.04$) and frequency of thoughts of being unable to complete the task ($P<.008$). No significant differences among the five groups were obtained on the measures of overall performance, ability to follow treatment directives, perceived effort or helpfulness of treatment.

Tables 4 and 5 contain a summary of the critical Q-values derived from the Newman-Keuls test of significant contrasts on the measures of discomfort and frequency of thoughts of being unable to complete the task.

On the measure of discomfort, results indicate the arousal group reported significantly greater discomfort as compared to the relaxation group ($P<.01$). Of note, contrasts between the distraction and arousal groups as well as between the relaxation and control group both approached significance ($P<.06$).

Results also indicate the arousal group reported a significantly greater frequency of thoughts of being unable to complete the task as compared to both the distraction and relaxation groups ($P<.05$). There were no significant differences between treatments and controls on this measure. However, it is noted that the contrasts between the attention to task group and distraction group approached significance ($P<.06$) on this measure. Another feature of note in this analyses is the large variability within groups

TABLE 4

Critical Q Values Derived From Newman-Keuls Contrasts on Group Means for Reported Discomfort

GROUP	DISCOMFORT 1	2	3	4	5
1 Attention to Task	--	2.78	.74	2.78	.74
2 Relaxation		--	2.04	5.56*	3.52
3 Distraction			--	3.52	1.48
4 Arousal				--	2.04
5 Control					

Standard Error=.43, df=85
* P<.01

TABLE 5

Critical Q Values From Newman-Keuls Contrasts on Group Means for Frequency of Thoughts of Being Unable to Complete the Task

GROUP	FREQUENCY OF THOUGHTS OF BEING UNABLE TO COMPLETE THE TASK 1	2	3	4	5
1 Attention to Task	--	3.13	3.52	.78	.65
2 Relaxation	--	--	.39	4.30*	2.48
3 Distraction	--	--	--	3.94*	2.78
4 Arousal	--	--	--	--	1.43
5 Control					

Standard Error=.43, df=85
* P<.05

on the measures of discomfort and particularly on frequency of thoughts of being unable to complete the task. High variability was also obtained on the measures of helpfulness of treatment and ability to follow treatment directives.

B. Performance Curves

In order to further assess the effects of the treatments, a multivariate analyses of variance (profile analyses) was used to test for significant differences between the mean distances travelled in each of six, one minute intervals (performance curve) for five groups.

Table 6 summarizes the multivariate analyses of variance of the differences among the five groups. Tables 7 and 8 summarize the results of the tests for parallelism of profile line segments and equal mean profile effects respectively. This is followed by the means and standard deviations for five groups for each time interval (Table 9). Figure 1 displays the respective performance curves for each of the four treatment groups and control group.

Results indicate no significant overall differences among the five groups. Similarily, no significant differences were obtained from the tests for parallelism of profile line segments or equal mean profile effects.

TABLE 6

Summary of Results of the Multivariate Analyses of Variance for Treatment Groups and Control Group on Distance Travelled in Each of Six, One Minute Intervals

DF1	DF2	OVERALL F	PROBABILITY	SIGNIFICANT CONTRASTS
24.0	280.3	1.208	.234	NONE

TABLE 7

Summary of Results of Test for Parallelism of Profile Line Segments

DF1	DF2	OVERALL F	PROBABILITY	SIGNIFICANT CONTRASTS
20.0	269.6	1.236	.224	NONE

TABLE 8

Summary of Results of Test for Equal Mean Profile Effects

DF1	DF2	OVERALL F	PROBABILITY	SIGNIFICANT CONTRASTS
4.0	85.0	1.407	.238	NONE

TABLE 9

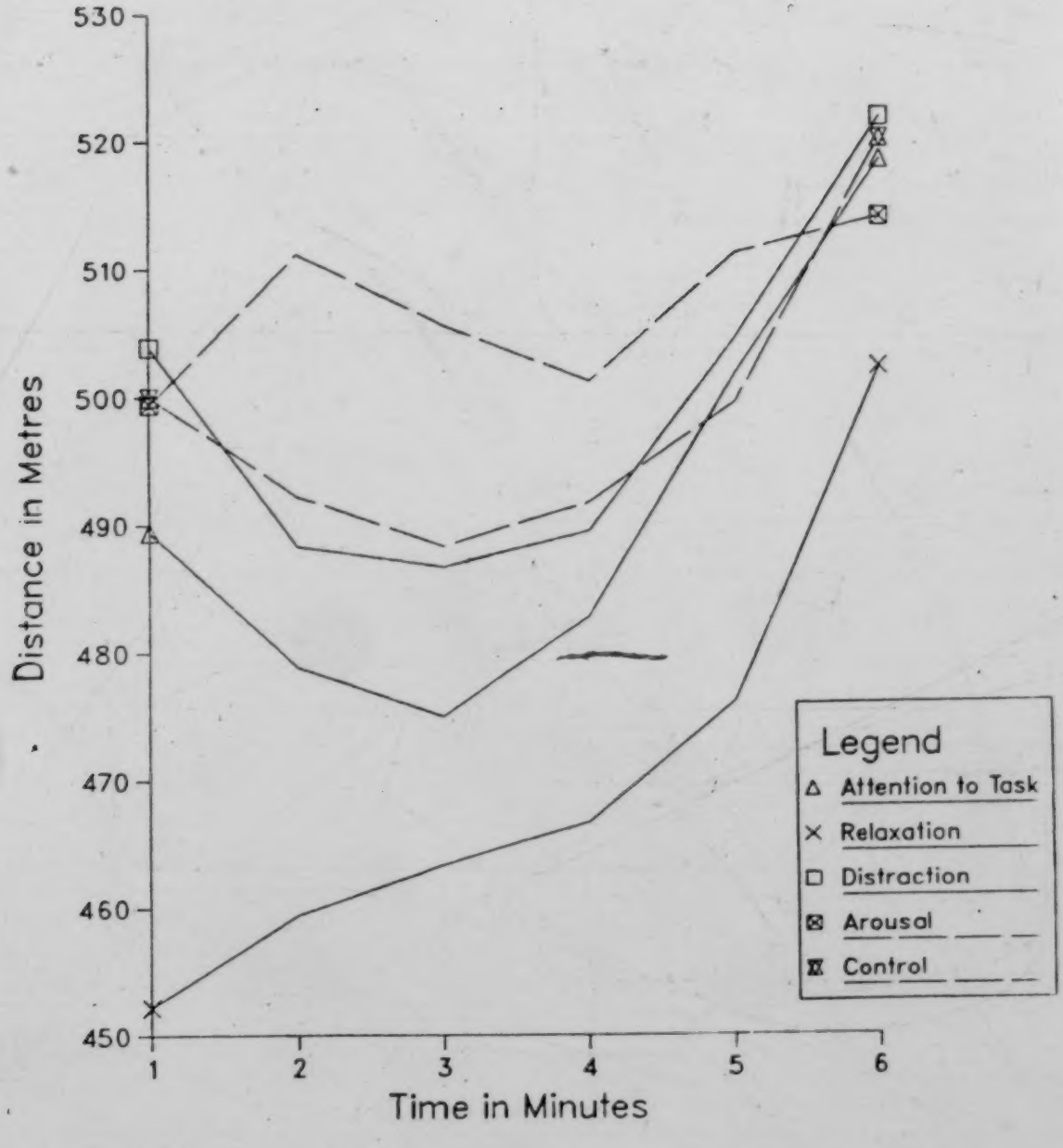
Mean Distances and Standard Deviations for Five Groups
in Each of Six, One Minute Performance Intervals

	(ATTENTION TO TASK)		(RELAXATION)		(DISTRACTION)		(AROUSAL)		(CONTROL)	
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
1*	489.44**	72.87	452.22	87.61	503.88	52.48	499.44	54.93	499.99	77.00
2	478.88	78.43	459.44	78.40	488.33	45.01	511.11	50.16	492.22	52.30
3	474.99	64.28	463.33	61.16	486.66	44.45	505.55	52.60	488.33	43.28
4	482.77	62.47	466.66	57.39	489.43	42.63	501.11	54.22	591.66	33.29
5	501.66	52.38	476.11	54.13	504.44	43.41	511.11	67.55	499.44	35.39
6	518.33	55.33	502.22	60.63	521.66	47.18	513.88	65.09	519.89	50.29

* Performance Intervals in Minutes
** Distance in meters

FIGURE 1

Mean Distances On Posttest For Five Groups Over Time



C. Correlations

In order to test the relationships between the dependent variables described in the previous chapter, Pearson Product Moment Correlations were calculated on the variables designated by research question number 5. In Table 10 the correlations for the combined groups are reported and Table 11 shows the levels of significance of these correlations.

Results indicate that 7 of the 15 possible correlations proved to be significant ($P<.05$).

Overall performance on post test was related to perceived effort ratings ($r=.36$, $P<.000$), frequency of thoughts of being unable to complete the task ($r=.24$, $P<.02$) and discomfort ($r=.38$, $P<.000$).

Perceived effort was related to thoughts of being unable to complete the task ($r=.26$, $P<.04$) and discomfort ($r=.56$, $P<.000$). Frequency of thoughts of being unable to complete the task was significantly correlated with discomfort ($r=.27$, $P<.011$).

Of particular interest, reported ability to follow treatment directives was inversely related to the perceived helpfulness of the treatment ($r=-.42$, $P<.000$).

There were no significant correlations between ability to follow treatment directives and overall performance ($r=-.06$, $P<.57$), perceived effort ($r=-.02$, $P<.81$), thoughts of being unable to complete the task ($r=.07$, $P<.55$), or discomfort ($r=.02$, $P<.81$). Similarily, no signficant

TABLE 10

Pearson Product Moment Correlations
Among Six Variables for Five Groups

VARIABLE	1	2	3	4	5	6
1. Overall Distance on Post Test	--	.36	.24	.38	-.06	-.06
2. Perceived Effort on Post Test			.20	.56	-.02	-.02
3. Thoughts of Not Being Able to Complete Task				.27	.07	-.04
4. Discomfort					.02	.08
5. Ability to Follow Directions						-.42
6. Helpfulness of Treatment						

TABLE 11

Levels of Probability of Pearson Product Moment Correlations Among Six Variables For Five Groups

VARIABLE	1	2	3	4	5	6
1. Overall Distance on Post Test	--	.000	.02	.000	.57	.57
2. Perceived Effort on Post Test			.049	.000	.82	.79
3. Thoughts of Being Unable to Complete Task				.011	.55	.70
4. Discomfort					.81	.46
5. Ability to Follow Treatment Directives						.000
6. Helpfulness of Treatment						

correlations were obtained between perceived helpfulness of the treatment and overall performance ($r=-.06$, $P<.57$), perceived effort ($r=-.02$, $P<.79$), thoughts of being unable to complete the task ($r=-.04$, $P<.70$) or discomfort ($r=.08$, $P<.46$).

D. Multivariate Analyses of Data

Employment of univariate statistics in analyzing data can give rise to two possible problems: (a) tests can be found to be significant due to chance because so many one way tests are repeated, and (b) certain data which are significant can be discarded because one is not able to analyze data on the combined effects of different variables.

In using a multivariate analyses of variance (MANOVA) the following variables were combined: (a) discomfort and frequency of thoughts of being unable to complete the task, (b) overall performance and perceived effort on post test, and (c) ability to follow treatment directives and helpfulness of treatment.

A summary of ANOVA and MANOVA results are presented in Table 12.

Results of the MANOVA indicated overall significant differences on the combined variables of discomfort and frequency of thoughts of being unable to complete the task ($F=4.01$, $P<.009$) and for the combined variables of ability to follow treatment directives and helpfulness of the treatment ($F=2.26$, $P<.04$).

TABLE 12

Summary of Results of Analyses of Variance and Multivariate Analyses of Variance

	ANOVA		MANOVA	
	OVERALL F	SIGNIFICANT CONTRASTS	OVERALL F	SIGNIFICANT CONTRASTS
Discomfort	4.14 P=<.004	4>2		4>2
			4.01 P=<.0009	
Frequency of Thoughts of Being Unable to Complete Task	3.68 P=<.008	4>2 4>3		
Overall Performance	1.24 P=<.30	NONE		
			1.70 P=<.12	NONE
Perceived Effort	2.21 P=<.07	NONE		
Ability to Follow Treatment *	1.44 P=<.23	NONE		
			2.26 P=<.04	NONE
Helpfulness of Treatment *	2.57 P=<.06	NONE		

* The control group was omitted from the analyses on these two variables in both the ANOVA and MANOVA.

In contrasting each of the four treatment groups and the control group with each other in the MANOVA, the results reveal only one significant contrast. This occurred between the arousal and relaxation treatments on the combined variables of discomfort and frequency of thoughts of being unable to complete the task. No significant contrasts were obtained among the four treatments on the combined variables of ability to follow treatment directives and helpfulness of treatment. However, a number of contrasts on this combined variable approached significance. This was most notable in the comparisons between the attention to task and distraction treatments and between the relaxation and arousal treatments ($P=<.06$).

E. Summary of Results

1. No significant differences were obtained among the five groups on the measure of overall performance. Research question 1 predicting a higher level of performance for subjects receiving the attention to task treatment was therefore not supported.
2. Research question 2 stated; What are the relative effects of the four treatments on subjects' experience of the task as measured by perceived effort, discomfort and frequency of thoughts of being unable to complete the task?

   Results indicated no significant differences between the four treatments as compared to the control

group on the identified experientiál variables. Between treatments, the results showed significantly higher levels of discomfort for the arousal group as compared to the relaxation group. Results further indicated a higher frequency of thoughts of being unable to complete the task for the arousal group as compared to both the distraction and relaxation groups.

3. Reseach question 3 stated; How do the four treatments compare on ratings of the treatments' helpfulness?

   No significant differences among the four treatment groups were obtained. Across treatments the mean rating on this measure ranged between 4 and 5 (undecided to somewhat helpful) with high variability associated with each group mean.

4. Research question 4 stated; Were the subjects able to follow the treatment directives as presented?

   Mean ratings on this measure ranged between 5 and 6 (most of the time to nearly all the time). No significant differences among treatments was indicated.

5. Research question 5 stated; What are the relative effects of the four treatments on subjects' performance curves (as measured by the distances travelled in each of six successive one minute intervals)?

   No significant differences were obtained among treatments or among treatments and controls.

6. Research question 6 stated; To what extent is overall performance, perceived effort, discomfort, frequency of

thoughts of being unable to complete the task, helpfulness of treatment, and ability to follow treatment directives related across groups?

Results indicated significant positive correlations between overall performance and the experiential variables of perceived effort, discomfort, and frequency of thoughts of being unable to complete the task. Ratings of the treatments' helpfulness were inversely related to reported ability to follow treatment directives.

Neither ability to follow treatment directives nor ratings of the treatment's helpfulness were related to overall performance, perceived effort, discomfort or frequency of thoughts of being unable to complete the task.

F. Further Analyses

In order to obtain further clarification of the above results further analyses were undertaken. These included analyses of the TAIS results to determine whether the index differentiated the attentional styles of high and low performers. In addition, subjects' reported attentional strategies were categorized. Finally, responses to the semi-structured interview were summarized and the relative rankings on the main outcome measures are presented.

Subjects' Attentional Strategies

Two sets of data regarding subjects' self generated attentional strategies were gathered. First, results from the administration of TAIS were employed as an experimental control to assess whether the groups differed in attentional style as defined by Nideffer (1976b). Second, additional data was obtained by requesting subjects to describe their usual cognitive strategies during performance. In the following both sets of data will be presented and analyzed.

Results of the TAIS

As previously noted, the five attentional scales of the TAIS defining attentional style were statistically undifferentiated among the five groups.

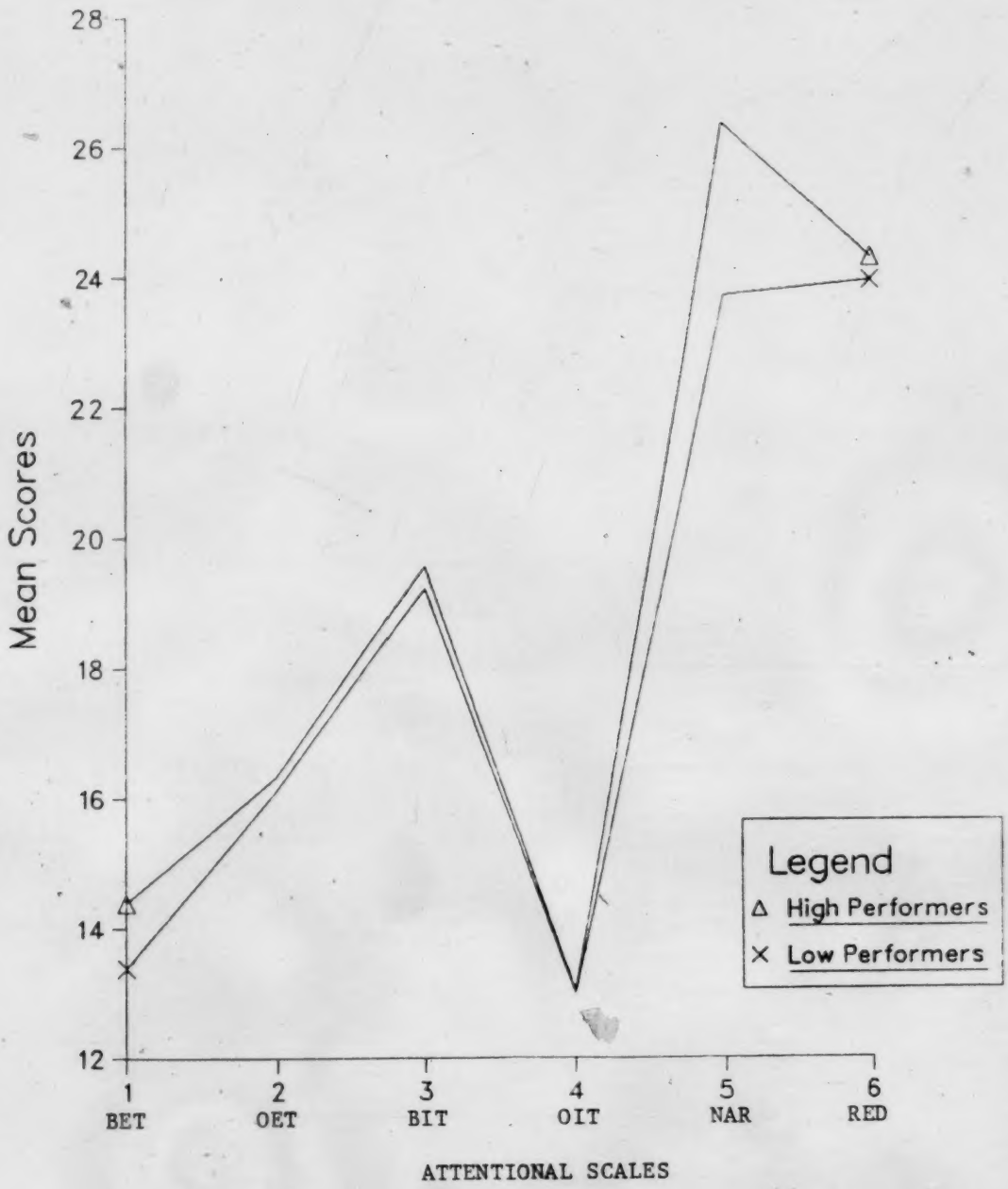
In order to determine whether the instrument differentiated high from low performers within the present subject population the following analyses were undertaken.

The entire subject pool was rank ordered on overall performance on the pre test. The upper and lower quartiles were identified as high and low performers respectively.

The mean scores on each of 6 attentional scales from the TAIS were plotted for the high and low performers (Figure 2). A multivariate analyses of variance (profile analyses) of differences between the groups was undertaken. The results indicated no significant differences between the profiles.

FIGURE 2

Mean Scores On TAIS Of High And Low Performers



Subjects' Self Reported Strategies

Subject responses to the question regarding cognitive strategies during performance (see Appendix I) were not appropriate for statistical analyses. In order to analyse these data, subjects' reported strategies were categorized along the following attentional dimensions.

1. ATTENTION TO TASK

   These subjects characteristically concentrated on race or game strategy, style of running, pacing, bodily feedback, and similar such task associated behaviors. Illustrative of this strategy are statements such as; "I concentrate on pace and try not to exceed my capacity by paying attention to breathing" or "I concentrate on a controlled even starting pace....I listen at all times to my foot rhythm and breathing."

2. DISTRACTION

   These subjects reported using an attentional strategy designed to avoid focussing on the specifics of the task at hand. Commonly, these subjects made statements such as; "sometimes I think of something very pleasurable (and erotic) while running" or "I do my best and that is the most I can do so I try not to think much while I'm playing."

3. AROUSAL

   These subjects reported attending to competitive factors such as defeating a particular opponent, attaining pre-set performance goals, or avoiding

humiliation associated with a substandard performance. This attentional strategy was typlified by such statements as; "I concentrate on performing better than my previous performance" or "I think of who we are playing and how much I would like to beat them."

4. RELAXATION

These subjects characteristically used a variety of simple relaxation techniques. Statements such as; "I tell myself to relax", "I warm up properly and relax as much as possible" or "I control my breathing in order to stay relaxed and not become too excited" are typical of this strategy.

While a number of responses reflected only one of the above dimensions, the use of an attentional strategy which reflected a combination of two dimensions was also reported.

Subject responses regarding attentional strategies during performance are categorized along both the singular and combined dimensions described above. The resultant frequencies are shown in Table 13.

Six responses were too vague or ambiguous to be categorized (eg. "I don't know what I concentrate on, I just play"). Of the remaining 84 codable responses, 37 indicated use of two attentional dimensions (e.g. relaxation with attention to task) and 47 reported using a strategy involving only one attentional dimension.

Attention to task strategies were most frequently reported (19 subjects) followed closely by arousal and

TABLE 13

Frequency of Reported Attentional Strategies Used During Competition

	ATTENTION	AROUSAL	DISTRACTION	RELAXATION
Attention	19	--	1	15
Arousal	17	17	--	0
Distraction	--	1	7	--
Relaxation	--	--	3	4

arousal with attention to task strategies (17 subjects respectively). Fifteen subjects reported using an attention to task with relaxation strategy which was followed by distraction (7 subjects), relaxation (4 subjects), and relaxation with distraction (3 subjects). Singular frequencies were recorded for the combined strategies of arousal with distraction and attention to task with distraction. No subjects reported using an arousal with relaxation strategy.

Results of the Interview

The responses to the interview questions regarding helpful and unhelpful aspects of the treatments and suggested improvements are summarized in Table 14.

Perhaps the most notable finding is the diversity of responses to the interview questions both within and across groups. Further, there was a generally low correspondence within each group between the reported unhelpful aspects of the treatment and suggested improvement. It is also of note that across treatments, subjects were generally more able to respond to questions regarding the helpful aspects of the treatments (53 respondents) and suggest improvements (48 respondents) than identify unhelpful aspects of the treatments (34 respondents).

Structural aspects of the treatments such as tone of delivery, number of required attentional shifts, use of the word concentrate, repetitions of the directives, periodic

TABLE 14

Summary of Subject Responses to Interview Questions Regarding the Helpful and Unhelpful Aspects of the Treatments and Suggested Improvements

TREATMENT GROUPS	HELPFUL ASPECTS	UNHELPFUL ASPECTS	SUGGESTED IMPROVEMENTS
ATTENTION TO TASK	Rhythm (5)* Breathing Encouragement (3) Pace (3) Repetitions of Instructions (1) Co-ordinating Rhythm and Feedback(1) Relaxed Tone of Voice (1) Use of Word Concentrated (1)	Balance (1) Breathing (1) All Instructions Were a Distraction (1) Focus on Energy Expenditure (1) Repetitions of Instructions (1)	More Time Feedback (4) More Repetitons (2) Less Repetitons (1) No Improvements Necessary (1) More Encouragement (1) Less Encouragement (1) More Emphasis on Physical Output (1) More Emphasis on Breathing (1) Get Mad at Us (1) Speak Louder (1) Review Before Giving (1)
NUMBER OF RESPONDENTS**	13	8	12
AROUSAL	Encouragement (5) Avoiding Failure (2) Time Feedback (1) Instructions Narrowed Focus of My Attention (1) References to Pride (1) Fact Someone Speaking to Me Helped (1)	All Distracted From Focussing on Body (2) Emphasis on High Performance (2) Tone of Voice (1) Reference to Pride (1)	More Time Feedback (2) Don't Extend Time (2) Review Treatment Before Task (1) Less Repetitions (1) More Enthusiasm (1) More Forceful (1) More Emphasis on Monitoring Bodily Feedback (1) Needs No Improvement (1)
NUMBER OF RESPONDENTS	13	8	13

* Frequency with which a particular aspect was identified
** Number of subjects responding to interview questions

TABLE 14 (Continued)

TREATMENT	HELPFUL ASPECTS	UNHELPFUL ASPECTS	SUGGESTED IMPROVEMENTS
DISTRACTION	Encouragement (2) Focussing Ahead in Time (2) Focus on Objects in Room (2) Instructions Distracted From Pain (2) Focus on Past Event (1) Limited Number of Concentration Points (1)	Focussing on Non Related Objects or Events (3) Instructions Interre Normal Focus of Attention (3) Time Feedback (1)	Emphasize only Task Related Behavior (2) More Interesteing (2) Review Before Giving (1) Less Repetitions (1) More Encouragement (1) Fewer Attentional Shifts (1) Make More Personalized (1) No Improvement Necessary (1)
NUMBER OF RESPONDENTS	13	7	11
RELAXATION	Emphasis on Legs (2) Emphasis on Upper Back (2) Relaxed Tone of Voice (1) Repetitions (1) Encouragement (1) Word Relax (1) Shoulders (1) Emphasis on Parts of Body Not Under Stress (1) Instructions Facilitated My Concentration on Style (1) Instructions Distracted Attention from Task and Allowed Me to Cycle More Easily (1)	Emphasis on Legs (5) Emphasis on Back (2) Focus on Aching Muscles (1) Focus on Muscles Not Under Stress (1)	No Improvement Necessary (2) Less Emphasis on Cycling (1) More Encouragment (1) More Emphasis on Upper Body (1) More Varied Encouragement (1) Less Emphasis on Legs (1) Keep Brief Stress Relaxation (1) Less Emphasis on Upper Back (1) Less Emphasis on Aching Muscles (1)
NUMBER OF RESPONDENTS	14	9	12

encouragement and elapsed time feedback were standardized across treatments. In respect to these aspects, encouragement was identified as most helpful (9 references) followed by tone of delivery (3 references), repetitions of directives, and use of the word concentrate (2 references respectively). The number of attentional shifts and elapsed time feedback received singular references as helpful.

Tone of delivery, repetitions of instructions, and elapsed time feedback all received singular references as unhelpful.

The most frequently suggested improvement was for more elapsed time feedback (6 references), more encouragement and less repetitions (3 references respectively) and more repetitions (2 references).

In terms of the treatment directives identified as helpful, there appears to be marginally more consensus within the attention to task group as compared to the remaining treatments. These subjects identified treatment emphasis on rhythm, breathing and pace as helpful in that order. In the arousal group only three subjects identified a treatment specific directive as helpful. The remainder of responses made reference to the general (and secondary) effects of the treatment (eg. instructions narrowed focus of attention) or referenced the treatments structural aspects as helpful.

In both the relaxation and distraction treatments greater consensus was obtained in response to the question

regarding the treatments unhelpful aspects as compared to the treatment's helpful aspects. In the distraction group, three subjects found focussing on non-task related objects unhelpful and an equal number felt the treatment interferred with their "normal" attentional processes. In the relaxation group five subjects reported concentration on relaxing the muscles in the legs as unhelpful, however, two subjects found this directive helpful. Similiarly, emphasises on the upper back was referenced as unhelpful and helpful by two subjects respectively.

The greatest diversity of responses occurred in respect to the question regarding suggested improvements. No clear patterns of consensus are apparent although three subjects suggested reviewing the treatments prior to the task and as noted more time feedback, encouragement and less repetitions were also suggested.

Non-Parametric Analyses

In using an analyses of variance to compare the effects of treatments between groups, the variation within a particular treatment, if large, as was the case on a number of measures in this study, tends to mask the differences between groups. If in fact, few subjects perform at the mean, reporting data as variations around the mean can be misleading. Furthermore, non parametric analyses can be of assistance in identifying data trends which may not be readily apparent through the use of parametric statistics.

In the following, the relative power effects of the treatments compared to each other and the control group were further analyzed by examining their relative rankings on the main outcome variables. The rankings on these variables are presented in Table 15.

Table 15 shows the arousal group ranked highest on overall performance, perceived effort, discomfort, and frequency of thoughts of being unable to complete the task. Conversely, the relaxation group were ranked lowest on these variables. The remaining treatment groups and controls occupied middle rankings.

The attention to task group ranked highest on both reported abiity to follow treatment directives and helpfulness of treatment. The arousal group ranked lowest on ability to follow treatment directives and the distraction group perceived the treatment as least helpful.

TABLE 15

Relative Rankings of Four Treatment Groups and the Control Group on Six Dependent Variables

	RELATIVE RANKINGS HIGHEST TO LOWEST				
VARIABLES	HIGHEST		MIDDLE		LOWEST
1. Overall Performance (Posttest)	4	3	5	1	2
2. Perceived Effort	4	3	1	5	2
3. Thoughts of Being Unable to Complete Task	4	1	5	3	2
4. Discomfort	4	5	1	3	2
5. Ability * to Follow Directions	1	2	3	4	N/A
6. Helpfulness* of Treatment	1	4	2	3	N/A

GROUPS

1 = attention to task
2 = relaxation
3 = distraction
4 = arousal
5 = control

* Control group omitted on these measures

V. DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

The purposes of this chapter are to discuss the results reported in the previous chapter, to summarize the conclusions drawn from the research, and to propose further areas of research.

The following discussion will first address the issue of whether subjects used the treatments as presented. This will be followed by a discussion of the correlational data and trends in the performance curves as they relate to the major findings on measures of discomfort and frequency of task incompletion thoughts. Finally, findings related to subjects' self reported attentional strategies will be discussed along with data arising from the interview.

A. Use of Treatments

Across treatments, generally high ratings on reported ability to follow treatment directives, and the low variability associated with each group mean suggest subjects were able to follow the treatment directives. This finding is at variance with a number of recent studies in the coping skills area (eg. Beach, 1981; Hackett, Horan, 1980) reporting subjects typically do not use the treatments as presented. However, the treatment delivery methodology employed in this study differs from that generally encountered in the coping skills area. Since these differences may have contributed to subjects' ability to follow the treatment directives, further discussion on this

topic is warranted.

The majority of studies in the coping skills area typically employ a coping skills training period prior to the administration of an experimental stressor. The present study departed from this methodology in three major respects. First, the treatments were administered while the subject was engaged in the experimental task. Thus learning and recall factors were likely not a critical factor interferring with subjects' actual use of the treatments. Second, defining the treatments as attentional directives permitted both greater specificity and parsimony. Dispensing with the need for much of the connecting verbage, characteristic of the more usual coping skills treatments, may have placed less demand upon subjects' critical listening ability and served to further emphasize the essential aspects of the treatments. This may be of importance, particularly in studies where the degree of stress a subject experiences may interfere with his ability to transform treatment instructions into coping behaviours. It is of interest in this regard that during the post experimental interview subjects frequently recalled specific words (eg. "relax," "pride," "concentrate") as either helpful or unhelpful but made few references to some of the more elaborate directives. Finally, the method of treatment administration in this study permitted use of the subjects first name which may have promoted greater responsivity over the seemingly less personalized approach of a pre-task

skills training method.

In summary, the specificity and parsimony of the treatments, in conjunction with the immediacy and personalization provided by the method of delivery may have contributed to subjects generally high ability to follow the treatment directives.

B. Overall Performance and Perceived Effort

While subjects were able to follow treatments as presented results indicated this apparently had little effect on either performance levels or the perceived effort associated with performance. The data therefore failed to support the hypothesis predicting higher levels of overall performance for subjects receiving the attention to task treatment. This finding is notable in its' apparent contradiction of the widely held belief that concentration on task specific demands facilitates performance in sports (Mahoney, 1978; Nideffer, 1976a). Furthermore, the control group was statistically undifferentiated from treatment groups on overall performance suggesting the treatments were neither more nor less effective in their influence on performance level than subjects self generated attentional strategies.

Consistent with previous studies (c.f. Borg, 1973) showing a high correlation between perceived effort and actual physiological output, the results showed perceived effort ratings were related to overall performance levels in

both the pre test and experimental phases of the study. Results further indicated no differences among the five groups on perceived effort ratings in either phase.

The accuracy of the PRE scale in reflecting physiological output suggests that it may be viewed, in part as a general measure of subjects effort motivation. The high rating on this measure, across groups suggests that the subjects employed in this study showed a high motivation toward the task which apparently needed little in the way of a reward or other inducement. More importantly, the treatments were evidently not sufficiently impactful as compared to each other or subjects self generated strategies to alter subjects' level of effort motivation, the perception of that effort or, as noted, corresponding levels of performance.

Before drawing the conclusion that attentional treatment strategies had little effect on performance levels or effort it is first necessary to consider the implications of the correlational and performance curve data on results pertaining to the experiential variables of discomfort and frequency of task incompletion thoughts.

In respect to the correlational data, results indicated a relationship between overall performance, perceived effort, discomfort and frequency of task incompletion thoughts. Apparently, as subjects expended greater effort, they travelled further, experienced greater discomfort and a higher frequency of task incompletion thoughts.

In light of these relationships it would be anticipated that significant differences on one or both experiential variables (discomfort and task incompletion thoughts) would be reflected in significant differences on overall performance or perceived effort. This was however, not the case. Results indicated the arousal group reported greater discomfort as compared to the relaxation group. The arousal group also recorded a higher frequency of task incompletion thoughts as compared to both the relaxation and distraction groups without a correspondingly higher level of overall performance or effort.

One possible explanation for these findings is suggested in a visual inspection of the performance curve data (See Figure 1). While statistical differences among the five groups were not obtained, there appears to be a trend toward distinct patterns of performance particularly for the arousal group as compared to the relaxation group. The attention to task, distraction, arousal, and control groups all tended to overshoot their preferred pace in the first minute of the task. This overshoot is evidenced by the pacing adjustment that subjects made through minutes 2 and 3. Where as the attention to task, distraction and control groups were able to adjust their pace in the second minute, the arousal group continued to accelerate through minute 2 and appeared able to make an adjustment only in the third minute. The arousal group then appeared to overshoot their preferred pace to a greater extent, and for a longer

duration than either the attention to task, distraction or control group.

The relaxation treatment, in contrast to the remaining groups, particularly the arousal group showed a more evenly incremental pace throughout the first four minutes. There was no apparent pacing overshoot or consequent need for adjustment.

From a purely physiological standpoint it is generally accepted that efficient aerobic performance follows what Ryder et al (1981) describe as the "aesop principle." The biophysical mechanisms underlying this principle are described in greater detail;

> The rate of oxidation for muscular effort is most efficient when it is aerobic, that is when the rate of utilization of energy is equal to the rate at which molecular oxygen is supplied the muscles...the muscles can obtain a small amount of reserve energy by reducing pyruvic acid to lactic acid... which cannot be metabolized at all in muscle cells. Since the energy available for either aerobic or anaerobic metabolism is thus limited by the rate at which it is consumed, this extra energy is available for only a limited time, measured in seconds." (Ryder et al, 1981; p. 112).

Consistent with this description an efficient aerobic curve, in the present experimental context, would likely show a fairly rapid acceleration to a pace dictated by the

rate at which the individual is able to provide oxygen to the muscles. This pace would be evenly maintained until the finishing "kick" which would be accomplished, in part anaerobically. Furthermore, errors in aerobic pacing may become significant in terms of discomfort depending on whether the individual is able to make an adjustment prior to the build up of lactic acid and oxygen debt.

Following from this it is possible that the arousal treatment, in emphasizing "motivation factors" tended to exaggerate the tendency toward early pacing errors. Comparatively, the relaxation treatment appeared to have a moderating effect on this tendency. Thus, in violating the "aesop principle," the arousal group may have been forced to perform anaerobically, for longer duration than the relaxation treatment. The relatively greater discomfort then may have been related to the physiological repercussions associated with early aerobic pacing errors. In this regard, the arousal treatment tended to interfere with efficient pacing as compared to the relaxation treatment. It is of further note, that apparently slight (i.e. not statistically significant) differences in pacing over the course of an event may be associated with significant differences in the level of experienced discomfort.

It is acknowledged that in the absence of precise physiological measures, the evocation of a physiologically based explanation must remain speculative. Nevertheless, the higher frequency of task incompletion thoughts reported by

the arousal group as compared to the relaxation group is consistent with a physiological explanation. That is, it is likely that as one experiences greater discomfort, there is a tendency to increasingly question one's ability to complete the task. However, group means were generally quite low which suggests that overall subjects did not question their ability to complete the task to any great degree. This may have been related to the relative brevity of the task.

Results further indicated that those treatment groups, reporting comparatively high levels of discomfort also tended to report correspondingly higher frequencies of task incompletion thoughts. There was however, one notable exception. While the distraction treatment did not significantly decrease discomfort as compared to the arousal treatment the results indicate the distraction group recorded a significantly lower frequency of task incompletion thoughts. Evidently, the frequency with which one experiences doubt regarding his ability to complete a task is not necessarily related to the degree of physical discomfort experienced.

These findings may have important implications for human performance and coping in both athletics and more broadly defined clinical concerns. In outlining a theory of self efficacy, Bandura (1977) contends that an individuals' belief in his ability to produce the behaviors necessary to a particular outcome (self efficacy expectations) influences effort expenditure, persistence, and coping efforts in the

face of obstacles and aversive experiences. While self efficacy theory is primarily derived from research on avoidance patterns, Mahoney (1978) has argued for its' relevance to wider areas of human performance. A number of studies (eg. Nelson and Furst, 1972; Taylor, 1979) have shown self efficacy expectations can affect athletic performance. The generality of these effects are further noted by Horstman (1972) in the area of sports nutrition.

In the present experimental context, the above findings on the measure of frequency of task incompletion thoughts may have a direct bearing on self efficacy expectation. If continuous cycling for six minutes is the desired outcome and the obstacle or aversive experience associated with that outcome is the degree of experienced discomfort, then the frequency of task incompletion thoughts represents the degree to which one's self efficacy expectations are eroded in the course of task performance. Within this theoretical framework, the results of this study suggest that a distraction treatment as compared to the arousal treatment, did not significantly decrease levels of discomfort but did significantly abrogate the erosion of subjects' self efficacy expectations normally associated with that discomfort.

Differences between the arousal, distraction, and relaxation groups on the experiential variables appeared to have little effect on actual performance levels. It should be noted however, that the task was of a relatively brief

duration. It is probable that the degree of discomfort and frequency of task incompletion thoughts (particularly if these are related to aerobic pacing errors) progressively undermines one's ability to perform an endurance event in proportion to the duration of the event. This raises the possibility that the treatment groups may have been statistically differentiated on the measure of overall performance given an endurance task of longer duration. With this in mind, group contrasts on discomfort and task incompletion thoughts which approached significance warrant further mention as potential data trends.

Less discomfort was reported by the relaxation group as compared to the controls ($P<.06$), and the distraction group reported less discomfort than the arousal group ($P<.06$). The distraction group also recorded a lower frequency of task incompletion thoughts as compared to the attention to task group ($P<.06$).

Overall there appears to be a pattern in which subjects receiving the attention to task and arousal treatments tended to experience greater discomfort and a higher frequency of task incompletion thoughts as compared to subjects receiving the relaxation and distraction treatments. The lower levels of discomfort for the relaxation group as compared to the controls may also be consistent with this, considering that the most frequently reported naturalistic strategies (See Table 14) involved attention to task and arousal strategies along both singular

and combined dimensions.

There are a number of aspects regarding the content of the treatments which may be relevant here. Both the attention to task and arousal treatments may be regarded as associative in content in so far as the directives made specific reference to task relevant behaviors (i.e. breathing, pacing, etc.,) or related concerns (i.e. doing well, avoiding failure, etc.). In contrast, the relaxation and distraction treatments were devoid of any specific direct or indirect reference to the task and were in this sense, disassociative. Assuming the accuracy of this general distinction, the pattern of results appears to suggest that the associative strategies (attention to task and arousal) tended to experience greater discomfort and a higher frequency of task incompletion thoughts as compared to the dissociative treatments (distraction and relaxation).

If these factors have a negative effect on performance over time, it is possible that dissociative strategies are more generally facilatitive of performance than associative strategies. Admittedly, such conclusions, in requiring a conceptual redefinition of the treatments must remain highly speculative. Nevertheless, this view is consistent with Morgan's (1977) study in which he reported significantly higher levels of performance on a treadmill endurance task for subjects administered a distraction strategy as compared to controls. Parallel to the findings in this study (See Table 14), Morgan (1978) subsequently found that distance

runners predominantly employed associative strategies. It is noteworthy, that in both this study and Morgan's (1977) study, associative strategies did not significantly facilitate performance in spite of their apparent widespread use.

This raises a number of important issues. First, in the clinical and athletic coping skills area it is assumed that those cognitive skills associated with effective coping and elite performance are, in some way, contributive. The results of this study and Morgan's (1977, 1978) findings open this assumption to interpretation. That is, while associative strategies are widely employed by runners, their particular level of performance may occur in spite of, not because of this strategy. It may be that the particular coping strategy adopted by an athlete may be for reasons, or as a result of experiences quite removed from improved coping or performance. In this regard, it is of interest that Fenz (1973, 1975) found similar patterns of arousal and attentional shifts when he employed experience and elitism (versus novice and non-elite) as independent variables in his study of parachutists. Clearly, experience and ability to perform are in most endeavors overlapping, however, it is possible that cognitive skills result from, or are potentially shaped by the length of time one has been performing.

In summary, trends in the performance curve data suggests errors in aerobic pacing may have resulted in the

higher levels of discomfort for the arousal group as compared to the relaxation group. It is suggested that this higher discomfort may have also eroded the arousal groups' self efficacy expectations reflected in higher frequency of task incompletion thoughts for this group as compared to the relaxation group. The distraction treatment did not significantly ameliorate the experience of discomfort as compared to the arousal treatment. However, the distraction group recorded a significantly lower frequency of task incompletion thoughts than the arousal group. It is suggested that compared to the arousal treatment, the distraction treatment significantly decreased the erosion of self efficacy expectations without altering the degree of discomfort experienced. Group contrasts which approached significance were discussed in terms of data trends. The possibility that associative strategies although more popular were in fact less facilitative than dissociative strategies in coping with performance related stressors was also raised.

C. Helpfulness of Treatment

Across treatments, mean ratings on the measure of helpfulness of treatment indicate the treatment directives were moderately well received. Results show no relationship between ratings of the treatments helpfulness and the performance or experiential outcome measures. Apparently, it was not the measured effects of the treatments that were

used by subjects as a basis for this rating.

There is some indirect evidence to suggest the degree of perceived similarity between the treatment and subjects' usual attentional strategy may have influenced ratings of the treatments' helpfulness. As noted above, the associative strategies of attention to task and arousal were the most frequently reported naturalistic strategies. Corresponding to this, the attention to task and arousal treatments were rated as relatively more helpful than the distraction and relaxation treatments. It is of interest that in fact, the findings indicate the relaxation and distraction treatments were associated with significant decreases in discomfort and frequency of task incompletion thoughts and were in this respect more helpful than the attention to task or arousal treatments. Thus, it is possible that subjects' perception of the treatment in part reflected their belief in the efficacy of their own particular strategy quite apart from any actual helpful or unhelpful effects of the treatments.

D. Ability to Follow Treatment Directives

It should be noted that the treatments were derived in part from those reported in the literature (c.f. Mahoney & Avener, 1977; Morgan, 1977, 1978) but more generally based on a theoretical position. As a result, the content of the treatments markly differed from subjects reported strategies. For instance, while the treatments were designed along a single attentional dimension (e.g. attention to

task, relaxation, etc.) nearly half of the subjects reported using a strategy which combined two attentional dimensions (e.g. distraction with relaxation, etc.).

There were also considerable individual differences in both content and emphasis from subject to subject within any given category of self reported strategy. The inherent differences between subjects' usual strategies and the treatments, may in part account for the inverse relationship found between reported ability to follow the treatments and ratings of the treatments helpfulness. That is, the more subjects concentrated on the treatments the more they were forced to abandon their usual strategy. This forced departure from an accustomed behavior may have induced some discomfort and disposed subjects to view the treatments as unhelpful.

Strong attachments to both functional and dysfunctional patterns of thinking and acting along with resistance to change, particularly in the absence of a complaint have been noted elsewhere by both semantic (Beck, 1976; Ellis, 1962) and systems therapies (Haley, 1963; Watzlawick, Weakland & Fisch, 1974). It should be noted in this regard, the volunteer subjects used in this study were not expressing any dissatisfaction with their pre-existing coping strategy. This factor may have influenced both how helpful the treatment was perceived (depending on the degree of similarity between the treatment and the subjects' strategy) and their motivation to follow the treatment directives.

This point may also be pertinent to those studies (Beach, 1981; Hackett & Horan, 1980) reporting subjects do not use treatments as presented.

E. Subjects Attentional Strategies

There is some evidence to suggest subjects reporting the use of a two dimensional strategy (i.e. distraction with relaxation) were not referencing a specific strategy per se, but a sequential series of strategies which may be more accurately described as a coping process. For example, subjects categorized as using an attention to task with relaxation strategy typically made such statements as; "As I start the race I usually try and settle down and relax as much as possible -- then I focus on maintaining good form, concentrate on my pace and breathing." It is possible that the initial strategy (in this example relaxation) provides a facilitative basis for any preceeding strategy. This process aspect was apparent in all of those subjects who reported using a combination of two attentional strategies. This suggests that what has been formerly conceptualized as a coping strategy may be more accurately described as a coping process, at least for some individuals. Furthermore, this process appears to be highly idiosyncratic, varying substantially from person to person.

The comparatively high frequencies with which subjects reported using attention to task and arousal strategies singularly or in combination suggests a fairly widespread

belief in the efficacy of these strategies. The relaxation strategy by itself was least frequently reported. However, relaxation combined with attention to task was reported with a relatively high frequency. It may be that for these subjects relaxation facilitated focusing on task specific demands as suggested by Nideffer (1976a). The reverse may be equally the case, that is attending to task facilitated relaxation or at least a decrease in levels of arousal. This is consistent with the findings of Fenz (1973, 1975) in his study of parachutists.

Three important methodological points are underscored here. First, the importance of clear delineation of the content of an attentional strategy; second, its' sequential relationship to any subsequent strategy; and third, the determination of how experience and or elitism influence both the content and process of coping strategies.

A number of factors which may have limited the accuracy of the data pertaining to subjects reported strategies should also be noted. First, there is the issue of how much access people have to their mental processes. Nesbett and Wilson (1977) state that accurate self report about thinking processes is not possible because one cannot be aware of one's own processes. Additionally, they contend what a subject is reporting on may or may not be the variable in question. Smith and Miller (1978) have tempered this argument somewhat by stating the central issue is under what circumstances people have such access. According to these

researchers, accurate self report is possible when the individual is performing tasks which are engaging and not overlearned. Apparently, access to mental processes about routine tasks is more limited. In this regard, some doubt arises as to the accuracy of self reports about strategies used during running events which may be considered a highly automatic, routinized activity. As a group, however, runners appeared to have little difficulty in describing their attentional strategies. The soccer players on the other hand were considerably less articulate. This may have been a function of their younger age and possibly less well developed oral and written communication skills.

Further limitations may have been imposed by the absence of a concise language with which to describe mental processes. Phrases such as "getting up" or "psyching myself up" were examples of frequently encountered descriptors, the meaning of which is largely a matter of conjecture. This is further evidenced in a number of previous studies (Sheton & Mahoney, 1978; Weinberg et al, 1980) in which subjects were instructed to "psych themselves up" and were subsequently found to have employed a variety of diverse strategies such as relaxation techniques, and increasing arousal among others.

Subjects' attentional style was further assessed through the administration of the TAIS. Results indicated no differences among the five groups. The instrument also failed to statistically differentiate high from low

performers on any of the six attentional scales.

It should be noted that while individual scores on each of the attentional scales varied considerably from subject to subject the group means for each scale tended to cluster at the mean of the scale. While the TAIS may have useful application on an individual basis, this regression tendency raises some question regarding its' suitability in group design research.

F. Post Experimental Interview

The purpose of the post experimental interview was to obtain additional data regarding the relative effects of the treatments. Few clear response patterns are apparent regarding specific treatment directives. Typically, those directives reported as helpful were found with near equal fequency to be unhelpful. Any consensus which was obtained involved very small numbers of individuals relative to the number of subjects in each group.

Individual preferences or beliefs in the efficacy of specific treatment directives may have been partially responsible for the diversity of responses. As noted above, the task was of a relatively brief duration which may not have given subjects sufficient experience to adequately gauge the teatments helpful or unhelpful aspects.

There is anecdotal evidence to suggest that subjects' usual attentional strategy may have influenced both how the treatments were received and the language used to describe

the effects of the treatment. For example, one subject receiving the attention to task treatment described the directives as "distracting." Further investigation revealed this subject naturalistically used a distraction strategy while performing. Paradoxically, a treatment emphasizing a task relevant focus was viewed as a distraction in so far as it interferred with his usual strategy. As noted earlier in the discussion regarding findings on the measure of treatment helpfulness, this anecdote appears to further underscore the possible interaction between subjects' pre-existing strategies and how the treatments were perceived.

Across treatments, a substantially higher percentage of subjects gave undetailed or vague responses to the question regarding the unhelpful aspects of the treatment as compared to the number of responses to the question regarding helpful treatment aspects. Subjects may have felt somewhat constrained in offering criticisms about the treatments directly to the interviewer who also authored the treatments.

Finally, approximately 2/3 of the subjects were incidentally asked during the interview if they could recall where they had acquired their particular strategy. Only one subject was able to relate the development of his strategy to an earlier experience as a high jumper in school. The remaining subjects had no specific recollection, nor could they recall ever having used a different strategy.

Similarly, when asked, none of these subjects could recall any intentional trial and error experimention of their strategy. This suggests that attentional strategies are long standing in nature and enacted in a rather automatic fashion.

G. Theoretical Implications of the Study

Theories describing the relationship between specific coping strategies and sports performance are as yet either non-existent or still awaiting further experimental and practical validation. This study as well as those cited in the literature review have been conducted on an exploratory basis. The concept of a coping strategy as well as the methods used to investigate the relative effects of various coping strategies have, for the most part, derived from cognitive skills research in the clinical areas (e.g. pain control, test anxiety, etc.). The findings of this study raise a number of issues regarding the conception of coping skills as it manifests in the sports performance area which may have relevance to clinical areas as well.

First, there is the issue of process versus content. For the most part, coping skills research assuming that the content of a particular strategy influence effective coping have focussed primarily on modifying a persons strategy during the experience of a stressor. The findings of this study suggest that what has been formerly conceived of as a coping strategy may be more accurately described along

process dimensions. That is, a persons focus of attention at any given point in time may be sequentially a product of what the individual focussed on previously. This may be of particular importance to athletics where the onset of a potential stressor can be anticipated well in advance. It may be that the nature of ones anticipation serves as a mechanism which triggers a particular coping strategy. This is consistent with Neissers (1976 cited in Eysenck, 1982) view that "Attention is nothing but perception, we chose what we will see by anticipating the structured information it will provide" (p. 76). If in fact this is the case, some questions should be raised as to the efficacy of attempting to modify a person's attentional strategy just prior to or during involvement with a stressor. Some consideration should be given to the anticipatory behavior and the sequence of cognitive behaviors which may ultimately result in the formation of a particular strategy during actual performance.

A second point here is that for runners at least, attentional coping strategies appear to be stable and persistent behaviours and not, as has been suggested elsewhere (c.f. Raphael, 1981) unsystematic, isolated events. This raises the theoretical possibility that coping strategies in athletics may be distinct from those encountered in the clinical areas and require a revised set of fundamental assumptions and investigative methodologies. For example, the long standing, repetitive nature of these

strategies suggests that successful modification is unlikely to occur on a one trial basis as is typically attempted in most coping skills research.

H. Suggestions For Further Research

Based on the information gained in the process of completing this study, and the research findings a number of topics for further research are noted in this section.

1. In general, a primary focus in the investigation of coping strategies in sports performance involves charting the complex relationship between cognitive and physiological events. Typically, studies in the sports area have focussed on one event or the other. There is a need for further research in which cognitive and physiological indices are examined co-incidentally. If coping strategies are in fact a process which is initiated at the point of conscious anticipation then it may be advantageous to simultaneously examine physiological and cognitive events both prior to and during actual performance.
2. Considerable ambiguity exists in the terminology used to describe cognitive coping strategies within both the scientific and lay populations. There is a need for the development of a mutually agreed upon language to describe attentional coping strategies. Ultimately, such a development may lead to a more valid classification schema.

Adjoining this issue, the central question concerning whether an individuals' access to his own mental processes would be enhanced by specific training in observing and reporting his attentional strategies. A relatively new although potentially reactive technique is described by Kazdin (1975) in which subjects describe their coping strategy as they are engaged in a given task. A number of thought sampling techniques have been reviewed by Kendal and Koreski (1979) which also warrant further investigation.

3. Further research is required into the cognitive events preceding the use of a particular coping strategy during actual experience of a stressor. This holds out the possibility that a more effective point of intervention may be defined other than when the individual is actually involved in the stressful event.
4. In investigating attentional strategies in sports performance the following questions should be examined.
   a. Does an individuals' focus of attention alter over the course of an event in relation to internal or external events?
   b. What is the nature of the interaction between a subjects pre-existing strategy and that offered by a particular treatment? For example, does the degree of perceived similarity between the treatment and the subjects pre-existing strategy influence his ability to follow the treatment directives or how

helpful or unhelpful the treatment is perceived?

c. Does an individuals' attentional strategy remain stable across different athletic events?

d. Is there a relationship between what an individual concentrates on during athletic performance and the length of time he has been participating in a given sport? For the most part studies in the area of coping skills and sports performance have attempted to examine the cognitive skills of elite performers. To examine the above question the overlapping variables of elitism and experience need to be separated in order to determine the relative effects of experience and elitism.

5. There is some evidence arising from this study that the length of the analogue task may not have been of sufficient duration for the treatments to have an effect on performance. It is suggested that future research in this area utilize actual events as the experimental context. Advances in telemetry have made this option increasingly viable and may provide more valuable data particularly at the exploratory stage which this line of research currently finds itself. Further to the point, the use of group research at this juncture makes in depth analyses of subjects' naturalistic strategies difficult because of the time and expense this may involve. Use of single case research may be of particular benefit.

6. Further research is required into the most effective means by which treatments can be administered. The treatment delivery methodology used in this study is one such innovation however additional measures such as presenting the treatments beforehand may provide greater impact. Another potentially effective technique would be to have the subject pre-record the treatment in his own voice for administration during actual performance. This may more closely approximate the self instructional process held by Miechenbaum (1972) to be a central mediator in behavior control.
7. The diversity of responses to the open ended interview questions suggests that future research into subjects' perception of a treatment be conducted on a more structured basis. This may have been accomplished in the present study by asking subjects to rate each attentional directive as opposed to choosing those which they felt helpful or unhelpful.
8. In the course of the post experimental interview a number of subjects noted that having someone speaking to them while performing was helpful. This raises the question of whether voice stimulation without specific directives would have affected performance or subjects experience of the task. This question should be investigated in future research.

I. Summary of Research Findings

The findings of this study are summarized in this section.

1. No differneces were found on the measures of overall performance or perceived effort among the four treatment groups. Further, there were no differneces on either measure between treatments and controls. However, on the experiential variables of discomfort and frequency of task incompletion thoughts, the relaxation treatment was found to be relatively superior to the arousal treatment. The distraction treatment was found to significantly decrease the frequency of task incompletion thoughts as compared to the arousal treatment. There were no differences between the treatments and controls on either discomfort or frequency of task incompletion thoughts. While attentional strategies affect the degree of discomfort and the frequency of task incompletion thoughts, these effects have little impact on actual performance in an endurance event of brief duration.
2. The treatments were neither more nor less facilitative than subjects' self generated strategies on performance levels or one's experience of the task.
   a. Self generated strategies most frequently involved the associative strategies of attention to task and arousal (i.e. concentration on motivating factors). In spite of the apparent widespread belief in the

efficacy of associative strategies there is no evidence to suggest they facilitate performance.

b. There is evidence to suggest that attentional strategies tend to be stable and long standing in nature, and not subject to trial and error experimentation by the individual.

c. For some individuals attentional strategies appear to be an integral part of a larger sequential coping process.

3. The performance curves were statistically undifferentiated among groups. However, comparisons between the arousal and relaxation groups suggest the arousal treatment may have interferred with subjects' pacing strategy which would account for the higher levels of discomfort and greater frequency of task incompletion thoughts reported by this group as compared to the relaxation treatment. With the exception of the relaxation group, all subjects tended to exceed their optimal pace in the first minute of performance. The relaxation treatment appeared to abrogate the tendency toward early aerobic pacing errors.

4. The TAIS failed to differentiate high from low performers. The tendency for group means to cluster about the mean of the individual scales suggest these indices may not be appropriate for use in group design research.

5. Subjects' rating of the treatments helpfulness appeared

to be unrelated to the measured effects of the treatments in terms of the performance and experiential variables. There is indirect evidence to suggest that ratings on this measure were influenced by the degree of perceived similarity between the treatment and the subjects more usual attentional strategy.

6. Subjects were generally able to follow the treatment directives as presented. This may have been related to the immediacy of the delivery methodology which also afforded greater personalization and verbal economy.
7. Subjects' post experimental comments regarding the treatments showed little consensus both within and across treatments.

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APPENDIX I

SUBJECT INFORMATION QUESTIONNAIRE

1. NAME _____ 2. AGE _____
3. WEIGHT _____ 4. HEIGHT _____
5. TEL.(Res.) _____ 6. TEL.(Work) _____
7. To the best of your knowledge are there any medical or psychological conditions which would make your participation in this experiment hazardous to your physical or mental well being?
   (circle one) YES NO
8. Are you interested in learning more about the psychological factors which may influence your athletic performance?
   (circle one) YES NO
9. Have you ever participated in competitive cycling?
   (circle one) YES NO
10. Are you currently in training for competitivie cycling?
    (circle one) YES NO
11. Do you believe that psychological factors have an influence on how well or consistently people are able to perform athletic tasks?
    (circle one) YES NO

12. How do you psych yourself up for an important athletic performance? I am particulary interested in what you think about during competition. Please describe briefly.

_____

_____

_____

_____

APPENDIX II

PRE TEST PHASE INSTRUCTIONS

As I explained to you earlier this bicycle is fitted with a small computer which measures how far you've travelled. I want to see how far you can go in six minutes. I will tell you when 2, 4, and 6 minutes are up.

This is a pre test to give you an opportunity to become familiar with the equipment and the nature of the task. As you know, I will be asking you back in about a week to complete the task again.

Now, take a few moments to get comfortable on the equipment and to warm up. Let me know when you're ready to begin.

Okay, remember I want to see how far you can go in 6 minutes. I will tell you when 2, 4, and 6 minutes are up, ready...go.

APPENDIX III

EXPERIMENTAL PHASE INSTRUCTIONS

Once again I want to see how far you can go in six minutes. I will tell you when 2, 4, and 6 minutes are up. This time, while you are pedaling, I will be giving you instructions on what I want you to concentrate on. Now, the instructions may sound artificial and may ask you to concentrate in a way which is unnatural. However, a part of your job here is to follow the instructions to the best of your ability. After the 6 minutes are up I will be asking you to respond to the following questions: How well you were able to follow the directions? How helpful or unhelpful the instructions were? The degree of physical discomfort you experienced? I am also interested in any additional comments you may have. Remember this is an exploratory study and I do not have any particular hypothesis so please feel free to respond openly.

Do you understand the instructions? Would you mind briefly repeating them so we can both be sure we agree on what you will be doing. Are there any questions?

Please let me know when you are ready to begin...O.K. remember I want to see how far you can go in 6 minutes...ready...go.

APPENDIX IV

ATTENTION TO TASK TREATMENT

1. As you begin to build up speed _____ (name of subject) I want you to concentrate all of your attention on how you expend energy through pedaling. Concentrate on keeping a perfect optimum balance between the effort you are putting out and the energy available in your body.

   PROMPT: That's it _____ (name of subject) concentrate on staying on that fine line between too much and too little energy output.

   PROMPT: Fine _____ (name of subject) perfect balance; concentrate; never too much or too little.

2. Now _____ (name of subject) focus your attention entirely on your pedaling. Concentrate on maintaining smooth, rhythmic rotations. Pay attention to keeping an even pace in perfect balance with the rhythm of your breathing, and feedback from your body.

   PROMPT: Good _____ (name of subject) concentrate; smooth rhythmic rotation, keeping an even pace, focus putting out just the right amount of effort.

   PROMPT: That's it _____ (name of subject) focus on smooth, even pedaling. Concentrate on keeping the effort of pedaling in accord with the sensations of your body.

3. Okay _____ (name of subject) now concentrate

solely on your breathing. Notice its' regular rhythm keeping pace with the rhythm of your pedaling. Focus on keeping your breathing smooth and effortless.

PROMPT: Fine ———————— (name of subject) concentrate on your breathing rhythm in perfect balance with the rhythm of your pedaling.

PROMPT: Good ———————— (name of subject) continue to concentrate on your breathing, keeping that same rhythmic pattern, easy even breathing.

4. Return your attention now to your body's internal functioning ———————— (name of subject). Concentrate on keeping that perfect balance between what energy is available and what is expended in pedaling.

PROMPT: That's it ———————— (name of subject) focus on keeping that perfect balance; attend to your body's messages; concentrate on expending not too much or too little effort.

PROMPT: You're doing fine ———————— (name of subject) concentrate on staying in tune with the feedback from your body.

5. Okay ———————— (name of subject) once again concentrate on your pedaling. Concentrate on maintaining smooth, rhythmic rotations in perfect balance with your breathing and bodily feedback. Focus on keeping an optimum pace.

PROMPT: That's it ———————— (name of subject) concentrate on the pace of your pedal rotations. Focus

on the connection between pedaling and energy expenditure.

PROMPT: Continue concentrating _____ (name of subject) stay on that fine line between too much or too little output.

6. Turn your attention now back to your breathing _____ (name of subject) concentrate on smooth, regular breaths - always in balance with your pedaling. Focus on keeping just the right rhythm, even, regular breaths.

PROMPT: Good _____ (name of subject) regular, even breaths; concentrate; notice your breathing keeping rhythm with your pedaling.

PROMPT: Focussing your attention on your breathing _____ (name of subject) your're doing fine.

APPENDIX V

RELAXATION TREATMENT

1. As you begin to build up speed _____ (name of subject) turn your attention to the muscular tension developing in your body. Concentrate particulary on your legs; focus on staying as loose and relaxed as you can.
   PROMPT: That's it _____ (name of subject) continue to focus all of your concentration on maintaining that sense of looseness and relaxation in your thighs and calves.
   PROMPT: You're doing fine _____ (name of subject) pay attention, concentrate, keeping your legs working loose, relaxed tension free.
2. Now _____ (name of subject) I want you to shift your attention to the muscles of upper back and shoulders. Concentrate all of your attention on keeping these muscles loose and relaxed, focus on pushing out any sensation of tightness or strain.
   PROMPT: Continue to concentrate _____ (name of subject) maintaining a feeling of loose relaxation in your upper back, and shoulders. Complete relaxation.
   PROMPT: Continue to focus and concentrate _____ (name of subject) allowing these muscles to work smoothly. That's it relaxed and loose.
3. Okay _____ (name of subject) now turn your attention to your lower back and mid section of your

body. Concentrate on making each individual muscle as relaxed and free of tension as possible. Notice the sensation of smooth, relaxed movement. Concentrate on keeping that sensation; loose and relaxed.

PROMPT: Continue to focus on your lower back and mid section _____ (name of subject) keeping the muscles loose and relaxed. That's it, relaxed and loose.

PROMPT: Good _____ (name of subject) concentrate, lower back, tension free, loose and relaxed.

4. Once again _____ (name of subject) turn your attention to the muscles in your thighs and calves. Focus all of your concentration on keeping the muscles in the top and side of your thighs, the large muscles in your calve loose and relaxed--completely tension free.

PROMPT: Concentrate _____ (name of subject) stay loose, careful not to tie up; working smoothly.

PROMPT: You're doing fine _____ (name of subject) keep your focus on maintaining looseness in your thighs and calves.

5. Now _____ (name of subject) shift your concentration back to your upper back and shoulders. As you concentrate you become aware of each individual muscle group. Pay attention to relaxing any muscle which feels tight. Concentrate on the sense of relaxation moving through your shoulders to your upper back, shoulder blades, and large muscle in the middle of your

back.

PROMPT: Continue to concentrate _____ (name of subject) on pushing out any tension in your upper back and shoulders. Focus on maintaining that sense of looseness and relaxation.

PROMPT: You're doing fine _____ (name of subject) concentrate, staying loose, pushing the tension out, not tying up.

6. Okay _____ (name of subject) again shift your attention to your lower back. Focus on each individual muscle; concentrate on keeping loose and relaxed. Concentrate on pushing out any sense of tightness, stay completely tension free.

PROMPT: That's it _____ (name of subject) keep concentrating on maintaining looseness and relaxation in your lower back.

PROMPT: Good _____ (name of subject) pay attention to maintaining that sense of tension free, relaxation.

APPENDIX VI

AROUSAL TREATMENT

1. As you begin to build up speed ———————— (name of subject) I would like to direct your attention on the energy and power in your body. Concentrate on giving your absolute maximum effort. Remember you will have only 6 minutes to show what you're capable of.

   PROMPT: That's it ———————— (name of subject) concentrate on pushing yourself toward maximum effort and performance.

   PROMPT: You don't want to let yourself down here ———————— (name of subject) concentrate on giving it everything you've got.

2. Now ———————— (name of subject) concentrate on what doing well at this task will mean to your pride and sense of self worth. Pay attention to the importance, of a good performance and how you may feel if you fail.

   PROMPT: That's it ———————— (name of subject) concentrate on success and the consequences of failure. Remember you're pride, don't let yourself down: go for it.

   PROMPT: Concentrating on doing well ———————— (name of subject) this is a question of pride.

3. Keep pushing yourself ———————— (name of subject) dig down deep give it everything you've got. This is your chance to show what you can do. Remember this;

concentrate on it.

PROMPT: That's it ———————— (name of subject) concentrate on giving it everything you've got--remember maximum effort--push..push..push.

PROMPT: Focus ———————— (name of subject) on the importance of a good performance. Concentrate on avoiding failure - keep your mind on this, concentrate. Concentrate on maximum effort; drive yourself.

4. Now ———————— (name of subject) turn your attention once again to the fact that this is your one opportunity to prove what you can do. Remember this...concentrate on it.

   PROMPT: This is your one and only opportunity ———————— (name of subject) concentrate don't let yourself down; push hard, go for it.

   PROMPT: Concentrate ———————— (name of subject) your pride is at stake here. You want to avoid failure.

5. This is it ———————— (name of subject) the one chance you have of showing your ability. Concentrate on giving maximum effort. Focus all of your attention on this one objective.

   PROMPT: Keep pumping yourself up ———————— (name of subject) concentrate on maximum output; this is your only chance.

   PROMPT: Remember your pride ———————— (name of subject) don't let yourself down, you only have a short time to prove what you're capable of.

6. Think and pay attention ———————— (name of subject) to the importance of doing well concentrate on continuing to put out your maximum effort, digging down for those last reserves.

   PROMPT: You've got to keep working ———————— (name of subject) think about doing well--remember maximum performance.

   PROMPT: That's it ———————— (name of subject) dig down for those last reserves, don't let yourself down, concentrate on finishing well.

APPENDIX VII

DISTRACTION TREATMENT

1. As you begin to build up speed ———————— (name of subject) I would like you to pick out an object in front of you other than the equipment you're involved with and concentrate on that object to the best of your ability.
   PROMPT: That's it ———————— (name of subject) concentrate on the object you have chosen; focus on the details, shut out all distractions.
   PROMPT: You're doing fine ———————— (name of subject) focus your full attention on the object. See if you can pick out any special details.
2. Now, ———————— (name of subject) turn your attention back in time, pick out an experience of importance to you and concentrate on it. What can you remember.
   PROMPT: That's it ———————— (name of subject) concentrate on the details of the event you have chosen, recall as vividly as you can.
   PROMPT: Concentrate ———————— (name of subject) focus your full attention on that past event. You're doing fine.
3. Okay ———————— (name of subject) now turn your attention forward in time to an up coming event of particular importance to you. Try to imagine clearly what it will be like, what you will be doing, who else

will be there.

PROMPT: Good ———————— (name of subject) continue focussing on the event you have chosen imagine it vividly in your mind.

PROMPT: As you concentrate ———————— (name of subject) what details of that future event can you focus on.

4. Fine ———————— (name of subject) once again bring your attention back to this room. Pick out an object, narrow your attention and concentrate.

PROMPT: That's it, concentrate ———————— (name of subject) focus on the details, carefully examine the object you have chosen.

PROMPT: Good ———————— (name of subject) rivet your attention on that object, notice the details you may want to think about what possible uses it has.

5. Now ———————— (name of subject) once again turn your attention back in time; pick out a recent event of importance or interest to you and concentrate on that event.

PROMPT: Good ———————— (name of subject) recall in as much detail as possible the details of the event you have chosen.

PROMPT: Keep concentrating ———————— (name of subject) focussing on that past event; remembering details you may have missed.

6. Fine ———————— (name of subject) now again turn your attention forward in time; again pick out an event in the future, and concentrate; for example, what will you be doing when you leave this experiment.

   PROMPT: That's it ———————— (name of subject) locate and concentrate on that future event. Push out all other distractions.

   PROMPT: Focussing your attention ———————— (name of subject) concentrating, picture the event you have chosen as clearly as you can in your mind. You're doing fine.

APPENDIX VIII

POST EXPERIMENTAL PHASE QUESTIONAIRE

ADMINISTERED TO SUBJECTS ASSIGNED TO TREATMENTS

Below are a number of questions regarding your experience in this experiment. Please read the questions carefully and circle the answer on the scale below each question which best describes your experience.

1. Indicate to what degree you were able to follow the directions you received while cycling.

1	2	3	4	5	6	7
not at all	very rarely	rarely	some of the time	most of the time	nearly all the time	all the time

2. The instructions I received while cycling were helpful to me in performing the task.

1	2	3	4	5	6	7
strongly disagree	disagree	somewhat	undecided	somewhat	agree	strongly agree

3. During the cycling task there were times when I thought I might not be able to continue.

1	2	3	4	5	6	7
strongly disagree	disagree	somewhat	undecided	somewhat	agree	strongly agree

4. Indicate the degree of physical discomfort you experienced.

1	2	3	4	5	6	7
very low	low	moderately low	undecided	moderately high	high	very high

5. Would you care to elaborate further on any of your responses above?

APPENDIX IX

INTERVIEW

1. In your opinion, how could the instructions you received be improved?

_____

_____

_____

2. Were there any aspects of the instructions which you found particularly helpful?

_____

_____

_____

3. Were there any aspects of the instructions you found particularly unhelpful?

_____

_____

_____

4. Is there anything I haven't asked you about that you think might be important for me to know?

_____

_____

_____

APPENDIX X

POST EXPERIMENTAL QUESTIONAIRE FOR CONTROL SUBJECTS

Below are a number of questions regarding your experience in this experiment. Please read the questions carefully and circle the answer on the scale below each question which best describes your experience.

1. During the cycling task there were times when I thought I might not be able to continue.

1——————2——————3——————4——————5——————6——————7
strongly disagree disagree undecided somewhat agree strongly
disagree somewhat agree agree

2. Indicate the degree of physical discomfort you experienced.

1——————2——————3——————4——————5——————6——————7
very low moderately undecided moderately high very
low low high high

3. Would you care to elaborate further on any of your responses above?

_____

_____

_____

_____

_____

APPENDIX XI

PERCEIVED RATE OF EXERTION SCALE(PRE)

6

7 Very, very light

8

9 Very light

10

11 Fairly light

12

13 Somewhat hard

14

15 Hard

16

17 Very hard

18

19 Very, very hard

20